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[OFFICIAL NOTICE.]

Experience Section, Pacific Coast Gas Association.

OFFICE OF THE EXPERIENCE EDITOR,
ROOM 610, 445 SUTTER STREET,
SAN FRANCISCO, CAL., June 26, 1910.

To the Members of the Pacific Coast Gas Association: Someone has said that "Education is not the result of a course of study; it is the result of a course of experience." And the Editor of your Experience Department, whom you honored by that appointment at the last meeting, would like to have you share with him a bit of experience that has helped to make you successful, so that he can tell it to the Association at the Los Angeles meeting, which is so near at hand—September 20, 21 and 22. The name of the sender will be treated confidentially, if so desired.

Faithfully yours,
LEON B. JONES, Editor.

BRIEFLY TOLD.

THE MID-SUMMER MEETING, SOCIETY OF GAS LIGHTING.—This year's mid-summer meeting of the Society of Gas Lighting was, as is the usual result of the experiences of those who have attended its former reunions, an occasion well to be remembered. Here is the story thereof in respect to the meeting of 1910, as recounted by one who has attended about as many of the mid-summer sessions as any other member:

Dear JOURNAL—No doubt you will be pleased to have a line or two, in the matter of the mid-summer meeting of the Society of Gas Lighting, from one who participated in its pleasures. This happening is of record of July 14th, the day being as faultless atmospherically as the doings were of fraternality. Through the kind invitation of the genial Engineer-Manager of the Lynn (Mass.) Gas and Electric Light Company, Mr. Charles F. Prichard—incidentally, the aforesaid Prichard seems to be either the consulting engineer or controlling genius of about all the suburban gas corporations of the North Shore of Massachusetts Bay—the Society held its regular meeting for July in the handsome quarters of the Corinthian Yacht Club, Marblehead. The New York contingent came to hand in two sections, one via the outside line to Boston, the other journeying by the all-rail route, but both joined happily with the home forces in that well-loved, time-honored old hostelry, known to the world as "Yonng's." All were in time for breakfast, too, which did not at all detract from the feeling that all was well. Breakfast over, we put ourselves under the direction of the capable and ever-ready representatives of the Boston Gas Light Company, headed by Mr. Wood, and abetted by a special representative of the Charlestown Gas Company, Mr. Fowler. Under their capable direction we were transported through the subway to Malden. Here we were received by Brother Prichard, who was in command of two fine specimens of the genus auto, Packard type. And what a delightful ride we enjoyed. For over 50 miles we journeyed through an almost unbroken chain of handsome residential section, over the most perfect of roads. In quick motion we ran through these—Revere, Lynn, Salem, Nahant, Swampscott, Beverly, *et al.* At the last named place is located the summer home of President Taft, an inspection of which was rather hastily made; but you may take it from me that our big President has some taste about the rigging and belongings of the place wherein some of his summertime outing is spent. From the Taft place to Marblehead was our subsequent route, and into the beautiful quarters of the Corinthian Yacht Club, where a truly great and good shore dinner was served. I do not indeed say too much when I say it was thoroughly enjoyed by all. At this date perhaps it is a trifle back to expand on the delights—palatable and mental—that were our portion. Enough, then, to say the viands were put away and the speeches were listened to in the spirit that causes all words to seem wisdom, that makes all the world akin. All too soon, in fact, the declining shadows pointed the closing of the day, so again to the autos for a quick trip to Lynn, and a delightful trip it surely was. Next in route were the comfortable seats of the excellent cars of the New York, New Haven and Hartford system, direct to New York and home. The man from

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Lynn not only proved himself once again and anew an accomplished host, whose range was ubiquity and whose zeal was interminable, and of whose versatility new and convincing proof was submitted. The new phase so strongly illustrated was the convincing demonstration of his ability as a chauffeur. In our drive over the magnificent park roads of this Eastern section—New York has absolutely nothing to even compare with them—our silent man reeled off a pace well over 25 miles an hour, without a "rock strain" let alone a "strong jar." So ends this short tale of a trip well taken, and to end it fitly, let me say the Society is to be congratulated over having in its membership so many of the New Englanders, to which section is due the full meed of that fraternity which binding string is that of loyalty to their profession and to each other.—VETERAN.

CURRENT MENTION.—

MR. H. T. DUKE, of Philadelphia, writing to us under recent date, says that the Court of Montgomery county, Pa., has decided in favor of the Montgomery Heat and Fuel Company, wherein the Borough Council of North Wales was enjoined from interfering with the Company's men in putting down the lines of gas mains. The Borough had granted a franchise to the proprietors of the Philadelphia Suburban Gas Company and endeavored to stop the Heat and Fuel Company from exercising its rights under a prior franchise. The Montgomery County Company will—so writes Mr. Duke—now lay about 20 miles, put in 2,000 services and set 1,500 gas stoves, without charge to the consumers, and the Company will expend about $20,000 in bettering its plant. There has been a queer sort of delay in carrying out this purpose, and others in interest than the Montgomery Company insist that were it not for the course taken by the Philadelphia Suburban the residents of the districts concerned would not have gas this winter.

SOME time ago we noted that Mr. H. E. Clay had been appointed Manager of the Oskaloosa (Ia.) Gas Company. This was an error, the fact being that Clay has been appointed Manager of the Edward Deane & Co.'s plant at Vincennes, Ind., known as the Vincennes Light and Power Company, and that Mr. J. F. Griffin, his predecessor at Vincennes, has accepted the place of Manager at Oskaloosa. The Deane Company is not yet in control of the Oskaloosa property.

SOME days ago the Massachusetts Board of Gas and Electric Light Commissioners gave a public hearing under the resolution of the last Legislature directing an investigation of the matter of the transmission of electric current of high voltage in the State, and to report to the next Legislature what changes in the present laws are necessary to provide for their new feature of electrical development. Everett W. Burdett, Counsel for the Massachusetts Electric Light Association, and the representatives of several street railway companies, said the existing laws are fundamentally correct, but were far from complete, so that attorneys advising companies like the Connecticut River Transmission Company, which is generating power on the Connecticut river just north of the Massachusetts line, and transmitting to Fitchburg, Worcester and other centers, have to guess as to how these laws shall apply to the new situations arising. As it is now it is possible for the local authorities in one city or town to prevent erecting a transmission line through their territory and so completely shut off places beyond. To obviate that possibly the right of eminent domain might be suggested, but he believed some middle course could be agreed upon. Selectmen of several towns through which wires of the Connecticut River Company now run, told of the difficulties they encountered in handling the petitions for pole locations. "In this respect," adds the correspondent who forwarded this mention, "the Commissioners have a perplexing problem to handle; but there's little doubt, when all has been said and done over it, that that body will, as usual, have emerged with flying colors."

[No. V.]

Review of the Twenty-fifth Annual Report, Massachusetts Board of Gas and Electric Light Commissioners.

[Prepared for the JOURNAL, by MR. H. THURSTON OWENS.]

Percentages of Increase.—As in 1908, the Citizens Company, at Quincy, leads with the greatest percentage of increase; namely, 35.78 per cent. Those companies having an increase of over 20 per cent. are given in Table I., with the increase or decrease in the average price received.

TABLE I.—*Showing Companies With Over 20 Per Cent. Increase in Sales and Net Change in Selling Price.*

Company.	Percentage of Increase Over 1908.	Average Price. Decrease.	Average Price. Increase
Quincy	35.78	....	$0.04
Malden	27.89	$0.06	....
Revere	24.86	0.08	....
Easthampton	22.79	0.02	
Greenfield	21.41	....	0.02

The companies showing a decrease of over 5 per cent, with changes in price, were as follows:

Company.	Percentage of Decrease Under 1908.	Average Price. Decrease.	Average Price. Increase.
Vineyard	44.87	$1.09	...
Amesbury	13.40	....	$0.09
Marlborough-Hudson	8.90	....	0.04
East Boston	7.85	....	0.08

It would not appear, from the above figures, that the change in price bore any direct relation to the increase or decrease in sales. Other data concerning these companies is given in Table II.

TABLE II.—*Showing Mains Laid, Increase or Decrease of Meters, and Sales per Mile of Main of Companies given in Table I.*

	Mains Laid, Feet.	Meters, Number Increase.	Meters, Number Decrease.	Sales per Mile of Main, Cubic Feet 1909	Sales per Mile of Main, Cubic Feet 1908.
Quincy	53,848	851	..	534,146	466,387
Malden	37,318	1,895	.	2,287,554	1,869,539
Revere	19,704	864	..	1,660,201	1,448,096
Easthampton	3,493	96	..	1,115,394	979,745
Greenfield	63,260	191	..	551,949	896,964
Vineyard	148	....	95	716,306	1,314,607
Amesbury	1,786	....	66	308,761	359,913
Marlborough-Hudson	5,238	118	..	611,733	684,325
East Boston	2,927	676	..	4,862,019	5,368,231

The company showing greatest quantity of pipe laid, largest increase in meters and highest sales per mile of main for 1909, was Boston, the figures for the last 3 years being as follows:

Year.	Mains Laid, Feet.	Increase in Meters.	Sales per Mile of Main.
Boston, 1909	111,615	3,800	5,408,273
" 1908	115,964	1,056	5,237,800
" 1907	88,184	6,133	5,039,368

The total miles of main laid for the past 3 years were as follows:

	1909.	1908.	1907.
Mains laid, miles	180	86	211

Increase of Meters.—The increase in the number of meters shows up well, although behind 1907, the figures for the past 3 years reading as follows:

	1909 over 1908.	1908 over 1907.	1907 over 1906.
Meters	27,549	19,214	31,128
Meter lights	132,070	99,798	149,331
Prepay (included above)	6,418	6,110	21,391

About 25 per cent. of the meters in use are of the prepayment type.

Gas Stoves.—The figures relating to gas stoves supplied by the companies show that in two companies there was a loss: In Boston there are no gas stoves reported. In Lynn (the leader) there are 1.29 stoves per meter, or one stove for every 3.7 persons inhabiting the several communities served by this Company.

Output.—The companies reporting their greatest day's output as between 1 and 2 million cubic feet numbered five; between 2 and 3 million, five; and Boston with over 17½.

Sales Per Consumer.—Boston continues to lead in point of sales per consumer, increasing from 33,045 cubic feet, in 1908, to 33,688, in 1909. This is the only Company in the State showing over 30,000 cubic feet, surely not an unreasonable figure, so that the vast possibilities of the future are at once apparent.

Percentage of Cost of Coal Secured from Residuals.—In six companies the percentage of cost of coal received from residual products was greater than 50 per cent., against 7 companies in 1908, the highest being as follows:

	1907. Per Cent.	1908. Per Cent.	1909. Per Cent.
Lowell	70.87	62.83	60.19
North Adams	64.33	72.43	72.31
Salem	56.06	59.65	45.19
Gloucester	55.56	49.82	52.98
Fitchburg	51.54	51.23	50.98
Taunton	51.23	52.45	51.34

Street Lighting.—The data given on public gas lighting shows that in only 4 cities the number decreased, while in 18 the number increased, the total increase being 815 lamps. The figures submitted as to the revenue and expenses are given in such a manner as to be of little comparative value, and in fact serve well to indicate the attitude of the companies toward this important feature of the business. The reverse is true of the data on public electric lamps, for, although probably 30 or more types are listed, the relative prices can be compared without a great deal of effort.

Some New Forms of Photometrical Instruments.

[Forwarded by a CORRESPONDENT, London, England.]

In a recent number of the AMERICAN GAS LIGHT JOURNAL, some account was given of the matters which have been discussed at several meetings of the Illuminating Engineering Society in London, devoted to "The Measurement of Light and Illumination."[1] The subsequent evenings also devoted to this subject on April 14th, and the first annual meeting of the Society, June 23d, were again productive of very interesting discussions and a number of new photometrical devices were exhibited and described for the first time.

For example, besides the exhibition of the illumination photometers of Trotter, Harrison and Martens, which were shown on this occasion, and the daylight attachment for use with the first named, a novel photometric screen was shown by Mr. L. Wild. This screen really consisted in a modification of the "cut card" photometer. The difficulty in any form of photometer in which one illuminated surface is viewed through a hole in another is that it is so difficult to get an absolutely fine edge. Mr. Wild avoids this difficulty in a very ingenious manner. He looks at one illuminated surface through a hole in a mirror and also arranges so that the observer sees a reflection of the second photometric surface in this mirror. Now, the edges of the hole, which may be produced by scraping away the mirror surface, are naturally very sharp, for the thinnest silver deposit is extremely thin compared with any paper. As a result he finds that a very fine line of division between two surfaces viewed can be secured and correspondingly good sensitiveness.

On this occasion Dr. W. E. Sumpner's paper, on the suggested modification of the Ulbricht globe, was also presented, but this has already been noticed in this JOURNAL.

Several "wants" were also revealed by speakers at these meetings. Mr. J. G. Clark alluded to one difficulty often found in street photometry; that the lamps are so unsteady; and Mr. G. F. Boxall, in a subsequent communication, added that some street lamps were so flickering in action as to "almost defy measurement." Mr. Clark, therefore, suggested the possibility of devising some form of "ballistic photometer"—a photometer, that is, which would add up in some way a series of successive readings and automatically take the mean just as the Ulbricht globe takes the mean of the intensities in different directions. Something of this kind would be very useful for unsteady sources, but it is difficult to see how such an instrument could be contrived.

There seems, however, a need for some instrument for testing the steadiness of sources of light. One often hears that this or that lamp is "very steady," but there are at present few guides except personal impression on which to base comparisons of one lamp with another. The use of a selenium cell has recently been advocated by Presser in Germany. He makes automatic tracings of the fluctuations in a source of light by recording the changes in electrical resistance of a selenium cell under the influence of the lamps tested. It is said that the same method has been effectually applied to testing the variations in daylight illumination and the fluctuations in light during a solar eclipse.

In any case, the matter is certainly one which would repay attention, seeing how important a factor the "steadiness" of a source is rightly considered to be. For example, in the recent contract entered into between the Westminster City Council and the Gas Light and Coke Company, London, a clause specified that the source of light should be "of a steady, invariable character." But, as a correspondent pointed out in the last number[2] of the *Illuminating Eng neer*, how can one assert that any light is "of a steady, invariable character," unless some precise method of testing this point is also stated? At the meeting of the Society on May 23d two more new instruments were exhibited, both differing essentially from the ordinary types of photometric instruments for measuring illumination.

Mr. Hayden T. Harrison showed a novel and very compact apparatus, the nature of which will be understood from the accompanying illustration.

This consists merely of a box in which is placed a small glow lamp, *L*, lighted by an accumulator. This lamp, *L*, illuminates a strip of paper, its shortest distance from which is represented by *A* and its longest by *B*. The scale is partly translucent and partly opaque. An observer looking at it sees the translucent strip illuminated by the lamp behind, and surrounded by a white diffusing portion which receives the illumination to be tested. Now, the brightness of the strip

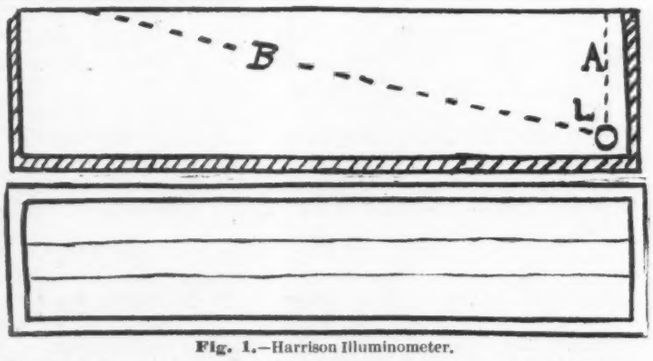


Fig. 1.—Harrison Illuminometer.

illuminated by the lamp, *L*, gradually falls off from about 100 to 0.1 foot candle. There will thus be a particular point at which its brightness becomes the same as that of the opaque, adjacent surfaces which receive the illumination of the room. All that is necessary, therefore, is to stand the book up in position on a table, or to hold it against the wall, when we desire to note the illumination, and to observe the point at which the strip just ceases to appear brighter than the surrounding surface. This gives us the illumination. The apparatus is naturally only intended for very approximate measurements, but it is extremely portable and, it is suggested, will be found useful by medical officers and others inspecting buildings who wish to form a rapid idea of the conditions of illumination which prevail. The instrument is also remarkable for the fact that a measurement can be made by mere observation of the scale, and it is not necessary to make any adjustment of its parts to take a reading.

Subsequently another instrument was shown by Mr. J. S. Dow. This also differed in several respects from the ordinary form of illumination photometer. It was intended mainly for the measurement of "surface-brightness" or "glare;" but, by a slight modification in its use, it could also be used for studying illumination.

The general nature of the instrument will be understood from Fig. 2. The eye of the observer, at *E*, looks through an aperture in the

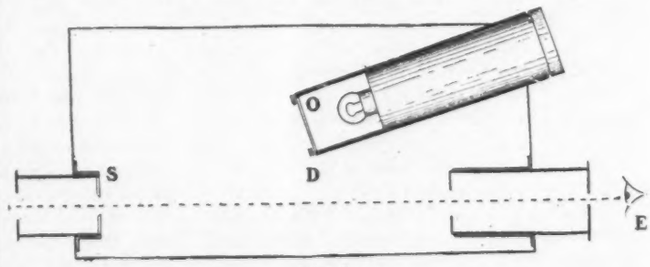


Fig. 2.

screen, *S*, at the surface whose brightness it is desired to measure. The illumination of *S* is provided for by the small glow lamp placed behind the opal screen, *O*. Matters are so arranged that this opal screen is equally bright all over, and to vary the illumination of *S*, a lever is brought across carrying with it a screen which obscures, to a greater or less extent, the opal plate, *O*. It, therefore, reduces at a uniform rate the intensity of illumination which is proportional to the exposed area. It is hoped by this means to obtain a uniform scale, which, of course, is desirable in a photometric instrument of this type. In the past it has been found possible to get a fairly open and convenient scale by using the inverse square and cosine law in combination; but this is only an approximation.

It will be observed that, strictly speaking, this instrument measures the "surface-brightness" of an object. It may be suggested that this is often a closer approximation to the ideal method of examining lighting conditions, because, in many cases, in reading for example, it is after all the *brightness* of the surface with which we are most concerned. For example, in a school one could use the instrument to examine the apparent brightness of the page of a book *just as it would appear to the child*. The resulting measurement would give us what was seen by the reader and would take into account the coefficient of reflection of the material of the page and the angle at which it is viewed.

On the other hand, it is always possible to use a standard white screen and, by noting the surface-brightness of this, to obtain a value for the existing illumination. This method would render it possible to obtain measurements in many cases in which it is inconvenient to to use an ordinary illu mination photometer. All that is necessary

1. See JOURNAL, May 30, 1910. 2. *Illum. Engr.*, London, July, 1910.

would be to fix up the standard white screen at the spot where we wish to ascertain the illumination, on a table, or against a bookshelf, or even on the walls or ceiling, and observe its brightness from a distance. It will be seen, therefore, that both the two instruments described on this occasion were somewhat outside the ordinary types. Probably in the future we shall see a great many varieties of photometers, all having their distinctive spheres of action, just as we have many different types of instruments for measuring gas and electricity to-day.

The meeting at which these instruments were described was of some historic interest, as the first annual meeting of the Illuminating Engineering Society, in Great Britain. One interesting announcement on this occasion was that Professor S. P. Thompson, the first President, had consented to continue in office for another year.

High Pressure in a Low Pressure System of Gas Distribution.

[Prepared for the Sixth Annual Meeting, Iowa District Gas Association, by MR. B. C. ADAMS, Lincoln, Neb.]

In presenting this paper I am complying with the request of your programme committee, to describe the condition of pressure under which we have distributed gas in Lincoln, Neb. Our plant is located at the extreme western border of the city, and all gas sent out passes through one main, feeding east. Branches are not taken off from the main until a point 1,600 feet distant from the plant is reached. The system is similar to the trunk and branches of a tree, but with all branches interconnected. The map attached is a skeleton showing the proportionate sizes of main. Out of 70 miles of main, over ½ is in 2-inch distributers.

In laying out the system it was at one time thought that Lincoln would develop southward, from the trunk feeder, and a feeder loop was laid near the south border. Lincoln has not only far exceeded the estimated growth in this southern section, but has enjoyed a remarkable growth in a northeast direction. Five years ago our feeder mains became too small to furnish adequate pressure near the city limits from the holder, and a centrifugal fan-blower was installed for the purpose of pumping gas over the peak loads. By means of the fan blower, we have gradually increased our plant pressure until last winter we reaced as high as 17 inches of water measured in a "U" gauge. Our peak output reached as high as 100,000 cubic feet per hour for 15 minutes. The highest pressure at which a consumer received gas was probably in the neighborhood of 14 inches, the lowest 1½ inches. The complaints we received under the above conditions of service came mostly from those getting around 1½ inches of pressure. Their complaint was that they could not get gas enough to cook with, and that their bills were higher than when they had gotten enough gas.

Those receiving what we would term "high pressure" said that if we would not pump so much air in the gas their bills would not be so high. They said the pressure was so great that the gas would blow out matches. When asked if the burner was adjusted to give proper flame, height or candle power, the answer was invariably, "Yes." These people have ceased to complain. The low pressure people have not.

We have found that the greatest source of complaint has come from varying pressures, and the electric light companies discovered this in the beginning. In order to eliminate this feature we are installing pressure governors which hold automatically the maximum pressure at 3½ inches. It costs us about 50 cents apiece to set these governors, in addition to their cost in the store room.

I think our experience should be valuable to the Association, as we have demonstrated the fallacy of the old rule of thumb that we should not exceed 5 inches of water pressure. Our gas, termed "lost-and-unaccounted," has not increased in per cent. as our pressure went up; it has decreased, as would be expected with an increasing output. A consumer connected to our gas mains wants all the gas necessary for the use he is making of it, and it is better to have more pressure than necessary than not enough. As indicated above, the consumer naturally adjusts the gas valve to get the proper flame, height or candle power. I could make an exception of industrial consumers who should always get constant pressure, no matter what the limits of variation in the gas main.

State and municipal governments have placed maximum and minimum limits on pressure at which gas can be distributed, and by so doing have caused consumers inconvenience and the gas companies needless expense. In fact, the maximum in Lincoln is 5 inches and the minimum 1½ inches, and if we had lived up to the maximum requirement, more than half of our consumers would have been without gas last winter at times. Our experience would teach that the minimum should be set higher, the maximum being left out altogether.

Had we increased our trunk feeder to a size which would have given ½ inch drop per mile of main, the net cost would have been, after giving credit for pipe taken up, $24,000 for 6,400 feet of main, and this would have been only a start in order to meet the ordinance requirement. Our blower equipment cost about $1,000, and the cost of operation last year was a little over $300.

One more point I want to bring to your attention is the fact that we have no trouble whatever with our meters, and have taken 500 3-light meters, which had been abandoned, and put them back in service in the high pressure district, where they give excellent service.

Boiler Fuel Leaks.

[Prepared for the Sixth Annual Meeting of the Iowa District Gas Association, by MR. EDWARD B. MYERS, Omaha, Neb.]

The study of boiler fuel leaks resolves itself quite naturally into these two main divisions: The losses sustained during the production of the steam, due to the poor design or improper operation of the boiler itself, and the losses or poor economy in the distribution or use of the steam after production.

The losses[1] incidental to production may be shown roughly rs follows:

	Good Practice. Per Cent.
Heat to steam	70
Loss in chimney gases	18
Loss due to incomplete combustion	1
Loss due to fuel through grates	1
Loss due to H_2O in coal and H in air and coal	3
Loss due to smoke and soot	0.5
Loss due to radiation and other losses	6.5

A certain amount of unavoidable loss, due to heat in chimney gases, is always present and is seldom less than 15 per cent. of the total heat supplied. Should the baffle-plates of a water-tube boiler, or the front smoke connection in a return tubular boiler, be badly in need of repair, the gases after combustion will often by-pass the tubes or water containing parts and greatly aggravate these losses. Ordinarily should a boiler be forced far beyond its rated capacity, the passings of the gases after combustion will be so rapid, through or between the tubes or water containing parts, that there will not be the proper time element for the necessary heat transfer which will result in high stack temperatures.

Loss Due to Incomplete Combustion.—This loss is due either to a deficiency or poor distribution in the air supplied to afford complete combustion of the carbon or hydrobarbons, or to a condition which reduces the requisite ignition temperature at the point where combustion should take place. Unless the firing is carefully done there will be times when the supply of air under ordinany conditions will not be sufficient for the combustion. It is usually much easier for the fireman to fire incorrectly than correctly. For instance, should a large quantity of coal be fired at one time all over the grate surface, there will be an increase in resistance to the passage of air through the fire bed. Now, the coal just fired will give off a large quantity of volatile matter for which there is need of an excess of oxygen for complete combustion, but since the resistance of the fire bed has been increased there will be a deficiency of air supplied under the grates causing incomplete combustion. Should the necessary air be supplied above the grates by cracking the furnace doors for a short period immediately after firing, this air, besides not being intimately mixed with the gases for proper combustion, would be very apt to lower the ignition temperature where combustion should take place.

The firing of large quantities of coal at one time also has a great tendency to reduce the temperature required for ignition of the gases, by reducing the temperature of the incandescent carbon and at the same time forming a sort of blanket between this incandescent carbon and the point of combustion.

1. Reference, "Steam Power Plant Engineering," C. F. Gebhardt.

In several tests recently made by the United States Geological Survey[1] at St. Louis, Mo., various methods of hand firing of Illinois nut coal were experimented with, natural draft being used on two Heine boilers, and the coal containing about 36 per cent. volatile matter. The results were as follows:

(1.) *Ribbon Firing.*—Fire alternately in narrow strips the full length of the grate. (Firedoors kept cracked.)

(2.) *Coking.*—Fire in the front of the boiler and allow part of the volatile matter to distill off, and then spreading.

(3.) *Alternate.*—Firing alternate doors of each boiler.

(4.) *Spreading.*—Fire 3 shovels on back of grate and two on front.

Method of Firing.	Efficiency Per Cent.	Average Interval between Firing, Minutes.	Coal Per Firing, Pounds.	Per Cent. of Rated Capacity Delivered.
Ribbon.....	62.2	2.3	50	107
Coking	60.5	7.4	140	95
Alternate.....	60.0	3.5	70	107
Spreading.....	58.0	9.3	170	93

From these tests we may draw the conclusions that frequent firing of small quantities over alternate grate surfaces will give the best results. Should the boiler be originally designed to burn coal low in volatile matter—*i. e.*, short distance between grate and tubes—the mixture of hot gases from high volatile coals impinging upon the water carrying parts may be lowered in temperature below that necessary for ignition with consequent poor combustion.

Loss Through Grates.—The quantity of partially consumed carbon which falls through the grate into ashpit will depend upon the size of the grate openings as compared with the size of the coal burned, small coals requiring smaller openings than large coals. Under especially good conditions this loss should not exceed 2 per cent., but where both large with small coal is burned on the same grates, it will often run much higher.[2] The size of the openings between the grates will also be governed by the formation of the clinker from the coal being burned. Where the ash has a tendency to form clinkers, which run into the small passages between the grates, it may become necessary to install grates with wider spacings.

A close inspection of ash dumps will often show a large amount of carbon discarded from under the grates. A correct analysis of an average sample, showing the free carbon in the ashes from under the grates, may prove it economical to install grates with smaller openings.

Presence of Moisture in Coal.—The presence of moisture in coal means that enough heat must be supplied to the moisture to convert it into superheated steam at stack temperature. Naturally the heat necessary to do this is not available for transfer to the water in the boiler and consequently is lost. The same condition is true of the hydrogen which forms water upon combustion and which leaves the stack as superheater steam. The loss[3] of 1 per cent. of the total heat value of the fuel is usually allowed for every 10 per cent. of moisture present in the coal fire.

When using bituminous coals or dust it is often advisable to dampen the coal before firing. Very fine coal will sometimes be carried into the flues by an active draught or else fall through the grate unless dampened. Where very fine coal flashes when fired a small quantity of water added before firing may be sometimes efficient.

Smoke and Soot.—The quantity and density of smoke issuing from a stack are not always criterions of the boiler efficiency. Under ordinary conditions, in order to consume all the carbon, such an excess of air would have to be supplied as to cause poor boiler efficiency.

Radiation and Other Losses.—Excessive loss due to radiation is usually due to faulty construction or deterioration of the brickwork. Firebrick should be used to form all services coming in contact with the hot gases. The walls should be made thick and constructed of hard, compact brick. In some cases a double wall is supplemented with a dead air space which acts as an insulator. The top of the boiler should be lagged with some good non-conducting material, as the prevention of radiation from the boiler is just as important as the prevention of radiation in the steam line. Cracks in the brickwork often allow the entrance of air much lower in temperature than the gases in the furnace. Heat is abstracted from the furnace gases, which proportionately reduces the amount of heat available for transfer to the water in the boiler. The amount of loss in this case depends upon the size of the cracks, and their location, together with the temperature of the entering air. A lighted candle passed slowly over the brickwork will often locate such leaks, which should be plastered up securely.

The loss[1] due to incrustation or scale has been estimated by various authorities as high as 13 per cent. fuel used where the scale was $\frac{1}{16}$ inch thich. The character or formation of the scale itself has probably a great influence on its insulating effect. The scale usually forms, first, on the hottest or lowest tubes, and heat not absorbed by these lower tubes so affected would probably be taken up by the tubes next above, so that the loss due to scale has probably been over estimated. Tests[2] made at the University of Illinois upon the conductivity of boiler tubes, with different thicknesses and character of boiler scale, show that one character of scale .02 inch thick caused a decrease of conductivity of 9.1 per cent. while an apparently similar scale, but 6.5 times as thick, showed only a decrease in conductivity of 7 per cent. From this it would seen that the chemical, as well as the physical, characteristics of boiler scale have a great deal to do with poor economy in the transfer of heat. The length of time a boiler should run depends upon several conditions, but will be influenced largely by the rapidity of scale formation. It should be let down often enough so that the tubes may be quickly and easily cleaned, as a boiler run for twice its regular period will take twice the labor to clean it thoroughly. Water tube boilers are usually provided with the side opening or ports by means of which the outside of the tubes may be cleaned of soot by steam jets.

The tubes of a fire-tube boiler may be cleaned by means of a scraper or steam jet. As carbon or soot acts as an efficient insulator the tubes should be cleaned frequently. The combustion chambers may become partially filled up with ashes, often to such an extent as to interfere with the passage of the gases of combustion.

The installation of automatic damper regulators is a great help to the fireman in the regulation of steam pressures, especially where one set is being operated in which it is necessary to keep the steam pressure almost up to the blowing point of the safety valves.

Losses Due to Distribution and Use of Steam.—The temperature of saturated steam at 120 pounds gauge pressure (sea level) is 350° F. Room or building temperature is 280° to 330° below this, depending upon the climate and season of the year. There naturally is a transfer of heat in such cases proportional to the difference between the temperature of the steam and the surrounding air, from which it will be seen how important and necessary it is that all steam lines should be carefully insulated from the surrounding air by suitable coverings. There may be short steam lines running through comparatively warm rooms, which it might be thought unnecessary to insulate; but, when the great difference in temperature is considered, the covering of all such pipes would be very economical. Where feed-water heaters are in use the feed lines running from the heater to the boiler should also be covered with insulating material to prevent radiation. Where and when it is necessary to run exposed steam lines out of doors they should be covered with insulating material, wrapped in some moisture proof covering, and painted with tar or some other good protective paint.

Small leaks in steam lines are apt to be noticed once and then tolerated until it is a common thing to have small leaks everywhere. Naturally, apparently small leaks at points of highest pressure, such as at boiler safety valves or boiler headers, are those giving the greatest losses. If an apparently small leak at 120 pounds pressure could be accurately measured and the consequent loss in boiler fuel shown, it would receive immediate attention. Steam leaks of all sizes should be repaired immediately. Leaky valves on steam lines to idle apparatus are often the cause of considerable losses. Should an idle apparatus, to which apparently the steam is shut off, feel warm to the touch, there very probably is a steam valve somewhere on the line badly in need of repair.

As the condition of the cinder dump often shows fuel losses, so does the condition of the works' drain, and boiler blow-off pipe often shows waste in steam or hot water with consequent loss in boiler fuel. These outlets should be closely inspected. Such inspections may probably be followed by the installation of new boiler blow off valves or readjustment of feed-water heater overflows.

It is always poor economy to ever drain any dead end of steam lines without the use of suitable steam traps. These traps, however, require constant supervision, as a by-pass valve may have been left open or a part corroded or a valve disk scored to such an extent that steam is being wasted.

Reciprocating steam pumps in perfect condition are in themselves

1. Bulletin 353; U. S. Geological Survey; Dept. Interior.
2. "Loss of Fuel in Ashes;" *Power*, March, 1905.
3. "Steam Power Plant Engineering;" by Gebhardt.

1. "Steam," Babcock & Wilcox Company.
2. "Railroad Gazette," Jan. 2', 1903, and June 14, 1901.

very inefficient, due to the fact that they do not make use of the expensive properties of the steam. They are very easily gotten out of adjustment and may by-pass steam directly through them at some or all parts of the stroke. The piston packings and steam valves need careful inspection and repairs from time-to-time to get even fair efficiencies. The piston rods are very apt to become worn down unevenly along their length, so that a stuffing-box gland, which is tight at one position of the stroke, may leak during the rest of the stroke. Such conditions should be remedied by installing new piston rods. These conditions are aggravated should the pump be too small for the requirements, causing it to be run at a high rate of speed, which results in the pump getting more quickly out of adjustment. Should the pump be too large for the requirements, and run at a low rate of speed, there will be a large loss due to condensation in the cylinders. From this it will be seen that all steam pumps need careful and frequent adjustments to reduce the steam losses.

There should be an economical use for the exhaust steam from all engines and pumps around the works. Probably the most efficient use to which it may be put is in heating the feed-water to the boiler. For every 10° the feed-water is raised there will be a saving of about 1 per cent in the fuel used, provided that the exhaust steam were not so used it would be wasted. For instance, the saving in fuel by heating feed water from 80° F. to 210° F., with boiler pressure at 100 lbs., would be 12 per cent.

The float valves controlling the inlet water to the open type feed-water heater need careful attention. The disks on such valves often become corroded or scored to such an extent that they do not close off properly, which causes the heater to fill up and continue discharging hot water through the overflow pipe to the sewer. This condition will often appreciably lower the temperature of the feed water to the boiler, since part of the available heat in the exhaust steam is being discharged into the sewer by the overflowing water.

Feed-water heaters should be regularly taken apart and thoroughly cleaned of deposits in order to keep them efficient. The frequency of cleaning will depend upon the composition of the available water supply. Efficiency of heating feed-water may be further increased by drawing the supply from the condensers after the water has served there in cooling the gas. There will probably be more than enough exhaust steam to obtain the requisite feed-water temperature. This excess steam may be economically used to heat works buildings, purifier house, etc.

A great deal of unnecessary steam is used to heat holders during the winter months in that, very often through lack of attention, the temperature of the water is allowed to rise above that required. Cases have been known where holder cup temperatures have been allowed to reach 90° F. during the warmer period of the winter. The valves on the heating devices may be advantageously throttled during such periods. There may be a great more steam used in the generators of a water gas machine than is necessary. If suitable steam measuring devices be installed the amount of steam may often be materially reduced with consequent saving in boiler fuel.

Where long steam lines or branch lines are in use it is good practice to have shut-off valves installed on each branch, close to the main line, so that in shutting off the steam it may be shut off as close to the supply as possible, thus avoiding unnecessary condensation losses. In order to determine the loss, due to condensation throughout the plant, steam should be shut-off close to each and every steam using apparatus. Then if the water discharged by the various steam traps be collected over a certain period and weighed the result will give the loss due to steam condensation.

Distribution in a Small Gas Plant.

[Prepared for the Sixth Annual Meeting, Iowa District Gas Association, by Mr. A. W. Borden, Hastings, Neb.]

As the subject in hand is a very broad one, I will be able only to touch on its most vital points. Representing, as it does, so large a proportion of the investment in a gas works, it is of the utmost importance that the distributing system be installed with greatest care.

The system of distribution starts with the station meter and ends with the consumers' appliances, and the construction and maintenance of that part of the plant, lying between and including these two extremes, will, in my opinion, call for more sound judgment and engineering ability than any other part of the plant. The object is to supply gas to the consumers at all times, at a uniform pressure, with as little loss as possible. Taken in order, this physical distributing plant is composed of the station meter, gasholders, street main governor, street mains, services and consumer's meter.

The duty of the street main governor is to regulate the pressure on the mains. If, of the automatic type, it automatically suits the supply to the demand by curtailing the volume and holder pressure during the hours of the lightest consumption. Thus the mains are not subjected to the maximum pressure during the whole 24 hours. However, the widely extended use of gas for fuel purposes in recent years, which insures a fairly even load for about 18 hours of the day, has induced in some plants the doing away with the governor entirely. In Hastings the old order of things has been reversed, as our heaviest load takes place during the day, the pressure being reduced after 7 P.M. Our maximum pressure is only 28/10 inches, and we are arranging to dispense with the governor and install a "booster" in its place, to increase our pressure during the noon and early evening loads.

As there is sure to be a greater or less percentage of lost gas, the only way in which one can at all times be informed as to the amount of this loss is to be provided with a station meter, which gives him a correct daily, and if need be hourly, report of the manufacturing conditions, and, each month after his sales are totalled, a check on the unaccounted-for gas item. This question is one that will have to be constantly dealt with.

The unaccounted for gas item may be divided into two classes: First, the discrepancy which may occur in the contraction, between the volume as measured at the temperature taken as the gas passes the station meter, and the temperature at which it leaves the holders or passes through the consumers' meters. The second class would be the actual loss sustained through the leakage from services, street mains, leaky holder seams or slow running consumers' meters. The former class, if allowed to appear from day-to-day, will render the appearance of "fat" manufacturing results, but after the sales are added up at the end of the month, Mr. Superintendent has to face his unaccounted-for gas item of cost. It is obvious that, where no station meter is used, this difficulty will not be confronted; but, on the other hand, the works operating without one is at sea most of the time with regard to the actual leakage loss. I believe that any works sending out over 20,000 to 30,000 cubic feet of gas per day should have a station meter. This part of the unaccounted-for gas can be eliminated from the cost sheet by daily readings of the temperatures at the station meter outlet, and the correction for volume calculated from the tables prepared for this purpose. This should be done by all means, in order that one may not be constantly deceiving himself as to the manufacturing results in his works.

A dry gas at 32° F. will expand 1/492 part of its original volume for each degree of increased temperature, or about 1 per cent. of its original volume for every 5° F. increase in temperature.

In a gas saturated with moisture, as is the condition of the gas passing through the station meter and holders, the tension of the vapors has to be taken into consideration, which renders this increase somewhat greater. Without going into the formula from which the calculations are derived I will merely state, for example, that a saturated gas, while registering 1,000 cubic feet at a temperature of 72° F., and 30 inches barometer pressure, will register 969 cubic feet at a standard temperature of 60° F., and the like barometer pressure, or more than 3 per cent. shrinkage.

If the station meter and temperature readings are correct, and if there is no loss of gas through leaky seams in the holders, one can arrive at the actual loss sustained through old or defective street mains and service pipes. If this item is found to exceed about 4 per cent. of the total sendout, or, in the case of a widely scattered distributing system, if it runs about 40,000 to 50,000 cubic feet per mile of main per year, as reduced to a 3-inch standard, it should be investigated. The mains and services should be barred for leaks; that is, a pointed steel bar should be driven down very close to the pipe at short intervals of space, and the holes thus made carefully examined for an odor of gas. If it is discovered that there is an escape, that point should be uncovered and the cause of same repaired at once. Such escapes may be found to arise from one of a multitude of causes. In the case of a cast iron main it may be a cracked bell, or the pipe may be found to have split, or it may be that the joint has been ruptured from the sagging of the main which would also be apt to break the joint of any service connection in that particular region. If such is the case, the joint will have to be cut out and remade. If it should be a short break, covering not over 4 or 5 inches lengthwise of the pipe, it may be quickly repaired with a split sleeve; but, if it is a long crack, the pipe would have to be cut out and replaced.

We find it the best plan to make a regular duty of this work each fall, after the rush of summer work has ceased to some extent. This work, to result beneficially, should be done carefully and patiently, and care be taken to bar in the direct vicinity of the service or main, where no chart of the position is at hand.

Both in the laying of new work and the repairing of old there are many cautions that should be observed, to the end that the leakage item be reduced to, and maintained at, a minimum. It is not considered practical to lay cast iron pipe of less than 4 inches in diameter and all 3 inches and 2 inches, or smaller main and service pipe, should be thoroughly coated. A good recipe for a pipe coating, commonly known as "Cremo" may be found in Vol. XIII., page 186, "Proceedings" the American Gas Light Association. This is a coal tar preparation that we have used by the dipping process and think it an excellent coating except that, unless it is made and applied with utmost care to keep it thin, it will prove very stubborn in drying and consequently hard to handle, We have secured the best results from a preparation made by the Highland Chemical Company, which we apply with a brush the same as paint, and it dries very firmly and quickly. An exhaustive article entitled "The Comparative Value of Various Coatings and Coverings for the Prevention of Soil and Electrolytic Corrosion of Iron Pipe," may be found in Vol. CVI., pp. 479, 528, 575, 629, American Gas Light Journal, August and September, 1909.

In laying a cast iron main, it should be properly graded or shored, and a light covering of dirt thrown upon it before the joint is made, unless the day be very cool, for there is sure to be some contraction of the pipe if formerly exposed to the hot sun. If possible, all joints should be thoroughly set and completely covered before night, if there is any danger of rain, as water will damage a freshly made cement joint.

If a new line of main is laid to re-enforce or re establish the supply on a street which is found to be furnished inadequately, it is never good practice to parallel the old line, which I think has sometimes been done. This simply increases the number of joints exposed to pressure and the possibility of additional loss. If the old line is not worth taking out of the ground, cut it off and leave it, turning in a proper size of pipe to take care of the district in question.

It is an age of expansion, and the superintendent of a gas plant in one of our small, but growing, Western cities, will have to exercise some rare judgment in planning his street main work. He may find that he is called upon to extend his service to outlying districts which will have to be supplied from the nearest accessible main which may be too small, and he will be obliged to increase the pressure at the works during the peak load hours until he can connect back, through the trunk line, from the source of supply. In a case of this kind, it is eminently the correct practice to install an extension of sufficient diameter to supply the immediate district and any probable extension of such district for an indefinite period, even though it must be temporarily supplied from a smaller main.

Services should never be less than 1 inch for ordinary dwellings, and, in Hastings, we have commenced this year to lay most of our services of 1¼ inch, because the additional weight of the larger pipe will much more than offset the added cost in length of life, to say nothing of the increased supply.

If a service is to be laid in a filled or made piece of ground, galvanized pipe should be used, for it is an established fact that the life of black pipe is very short in a bed of ashes or *debris* of like character. Some gas men even advocate the general use of galvanized pipe for service work. It may be a fair compromise to assert that an increased size of coated black pipe he used where there are prospects for an increase in consumption, and a galvanized pipe of 1 inch for the ordinary small consumer, or where the nature of the soil warrants. I think it an excellent plan to use galvanized fittings entirely for service work, as there occasionally is a black fitting with a sand hole which will escape the attention of the fitter. The process of galvanizing completely fills these small flaws.

In making a service connection from a wrought iron pipe, we invariably use the service-clamp or clip, which insures greater strength of the connections and renders as secure a joint as though the pipe were tapped. This clamp is also used on very small mains, such as 2-inch, which would otherwise have to be cut and a long screw-and-tee used, thus exposing more joint work to the pressure.

In laying cast iron pipe, with cement joints, a lead joint should be made up at every length of the line for expansion purposes. In laying screw pipe it is a good plan to lay an expansion joint coupling in each block, as a long line of screw pipe properly made up will be found quite rigid. All extensions of street mains should be recorded upon a suitable form of card, containing all particulars as to depth, location, etc., as determined from some fixed starting point, such as the curb, or, in the absence of a curb, a lot line may be used. From this it can be transferred to a scaled map of the district. A reading of the pressures should be taken every year in the several growing districts of the town in order to keep informed as to their needs.

In connecting up a number of meters from a large service, as in a large store or flat building, provision should be made to have them connected closely banked on a shelf and within easy access of the single service shut-off. This will facilitate their removal in case of fire, and the general position will render them more easily and more accurately read. I think a gas company can hardly be too small to have its meters numbered with a company badge and the meter record kept from this form of enumeration. Consumers' meters should be tested at least every 3 years.

We find it a convenient method to test each year ⅓ of our meters which have been in use for 3 years. This is an established duty to be attended to after the summer work is over. We do not consider it economical to repair our own meters. As a majority of the consumers' meters will be found running slow rather than fast, the superintendent will be afforded another check upon his unaccounted-for gas items. Care should be given to the stability of all parts of the distributing system, as depreciation counts up faster here than in any other part of the plant. In this connection I am favorably impressed with the idea of installing some form of cast iron cased consumers' meters with iron connections To my mind, other things being equal, this will go far toward holding down depreciation in that department.

The gasholders should be carefully scraped and painted at least once a year, thus minimizing the chances for a seam or rivet to become rusted through. A few small leaks of this character would get away with a large quantity of gas in the course of a year. A growing distribution department, if properly conducted, will afford the manager something to study upon all his spare time from other duties; and then some!

On Producing Ammonia from Nitrogen and Hydrogen.[1]

[Prepared for the American Gas Light Journal, by Mr. Frederic Egner.]

The production of ammonia from its elements, nitrogen and hydrogen, is of great technical significance, as the demand for combined (or bound) nitrogen is rapidly increasing, while the supplies from the Chilian saltpeter beds are decreasing, and the working up of coal, together with recovery of by-products, can only add a limited amount of ammonia to the market, since this is circumscribed by the call for coke.

Viewed economically the conditions are favorable, because nitrogen and hydrogen can be made for a fraction of the sum which is obtained in the market for their combination as ammonia. In the production of nitrogen and hydrogen cheap water power is not required. Consequently, contrary to the manufacture of saltpeter from atmospheric nitrogen, the synthesis of ammonia is possible also inland, provided that the process of combining the elements to form the same can be accomplished without especial expenditure of power.

Lacking great and cheap water power, as in Germany and other densely populated States of Western Europe, a process which permits the production, in any desired quantity, of the, to agriculturists, so indispensable combinations of nitrogen, and this without excessive application of power, is of utmost politico-economical importance.

To make ammonia from its elements was to date deemed impossible technically considered. The sluggish feebleness of nitrogen in reactions at low temperatures, and the slight affinity of nitrogen and hydrogen at high temperatures, seemed to exclude practical success.

The lecturer, however, together with M. Robert Le Rossignol, has disproved the above findings in a work undertaken and carried out jointly, and has demonstrated that, with the aid of pressures which exceed considerably those applied to date in gas reactions in technical operations, this process can be made a practical reality.

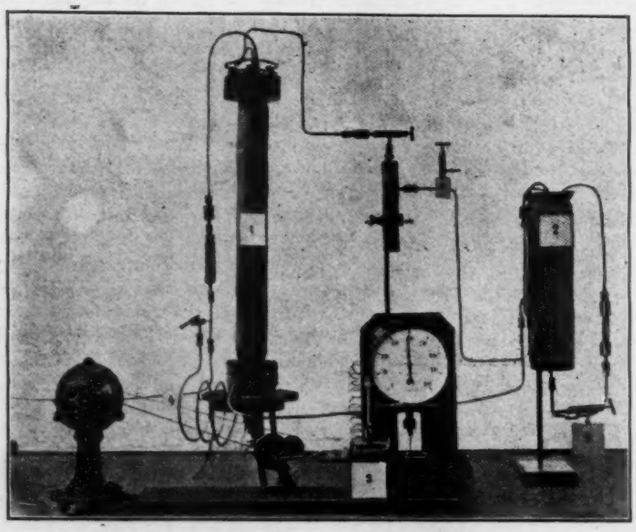
The apprehensions concerning a working pressure of 200 atmospheres, and the act at the beginning of our investigations, no less serious doubts if under such a pressure there would (for practical purposes required) be the rapidity of action within the (for solidity's sake restricted in dimensions) apparatus; furthermore, if the (for the

1. Abridged reproduction of a lecture and demonstration delivered before the Association of Natural Science, Karlsruhe, Germany, by Prof.-Dr. Haber.

process) necessary converters or reagents would prove reliable under continuous operation, or could be, and were, overcome and set at rest. But even under a pressure of 200 atmospheres the combination of the elements durng the practical conditions under review is so sluggish that one must form and remove the ammonia step by step. This can be well accomplished by means of a circulating system under constant high pressure, in which a generator, a separator and a circulating pump are connected in a circle.

The ammonia can be liquefied by moderate cooling in the separator, and can then, in the clear fluidic or gaseous form, be blown out. The uncombined portions of nitrogen and hydrogen remain in circulation.

The illustration represents such a high pressure circulating appa-



1. Generator with recuperator.
2. Liquefier with cooling exchange and stand-glass.
3. High pressure circulating pump.
4. Fresh gas supply.
5. Ammonia blow-off.
6. Test cock.

ratus for laboratory use (employed in demonstrating the subject in the course of the lecture) which was constructed at the Karlsruhe Institute for Physical Chemistry; and which, with a pressure of 185 atmospheres, produced 90 grammes of liquid ammonia per hour under continuous operation.

The generator can be rigged up with a recuperator heat, the importance of which increases the higher the temperature is under which the ammonia is formed in the same.

Instead of removing the ammonia by liquefaction it may also—either with retention of the pressure or after the expansion of the gas—be obtained by using absorbents.

Concurrent experiments concerning the ability of various converters (reagents) under pressures approximating 200 atmospheres led up to the knowledge that osmium developed a most excellent catalytic active result. For example: With a mixture of about three parts of hydrogen and one part of nitrogen, under a pressure of 175 atmospheres and temperature at about 500°, and with finely distributed osmium, there was easily obtained 8 + per cent. by volume of ammonia. But incidentally with the founding of the manufacture of osmium lamps, by Dr. Auer von Welsbach, he established the fact that the world supply of osmium was very small, in fact, does not materially exceed 100 kg.; and that the yearly additions are trivial in amount.

In consequence a second converter was sought, or one which would be found more plentifully deposited in nature.

This was discovered in uranium, which, in accordance with the periodic system of the elements, displays a similar relation to the feebly active chromium as does osmium to the also, for some time known, for a certain catalytic-active iron, uranium (containing carbon or carbide), which can be produced for instance in the electric light arc from oxide of uranium and carbon. It is reduced into a very fine powder when in the highly compressed gas-mass taking up nitrogen, and whose most excellent catalytic effectiveness in a temperature below 500° was demonstrated by the lecturer.

The compressed gases coming from the carrier entered a liquefier, furnished with a pressure-safe stand-glass, in which the increase of liquid ammonia during the experiment was shown by means of a projection onto a disk. By reason of these working results the foundation of an industry for the synthetical production of ammonia seems assured. The power requirement for compression and moving of the gases is very little. Heating and cooling needs, are after suitable determination of temperature in the generator, according to past experiences, of minor importance to the economical operation of the process. Therefore, it may be assumed that this process can be carried on inland, or in general, in such localities where coal to produce hydrogen may be had; while great and cheap water power, so necessary to the manufacture of air-saltpeter and other forms of nitrogen assimilations (making carbide of calcium from lime and coal, and conversion of the nitrite by superheating) may be dispensed with.

Based upon the fundamentals described, the Badische Anilin und Sodafabrik, at Ludwigshafen, has gone ahead and built successfully, so that the high pressure synthesis of ammonia from its elements can hereafter be considered among the processes upon which agriculture may rest her hopes, when, in view of the declining productiveness of the Chilian saltpeter beds and the circumscribed production from the nitrogen in coal, she is looking around for new sources of her most important fertilizing material. To the above the translator would add a few words, viz.: If it is possible to utilize the practically inexhaustible stores of atmospheric nitrogen in the manner described by Prof.-Dr. F. Haber in the preceding lines, or if the same may be, as the writer believes can be, accomplished by a still simpler and far more profitable method, then indeed the abandoned New England farms could again be profitably operated, and "The desert be made to bloom like the rose;" and such a process would be of inestimable value to mankind. Many have sought to solve the problem, among them the writer, who believes he came very near the object; and only lack of personal means and want of appreciation on the part of others who, though giving liberally of their wealth to educational institutions, yet failed to mentally grasp this stupendously important subject to mankind, prevented (let us hope only for a time) the successful achievement.

The Gas Sales' Expert.

By "R."

Four factors are essential in the making of a gas sales' expert. First, the gas sales' expert must make a study of the mechanical departments of the manufacture of gas; second, he must study modern methods as applied to the manufacture and sales of gas and gas appliances; third, he should study the economy of gas manufacture and distribution; fourth, he must make a study of the general business ends of the making and selling of gas.

Taking the first factor under consideration, we find that the divisions included in the heading marked study of modern gas plants: First, the machinery of the plant; second, gas cooking, heating and lighting apparatus and its uses; third, gas specialties. If a young man desires to get hold of the mechanical and business ends of the manufacturing and selling of gas according to modern methods, a very good way is for him to apply for a job in some reputable gas plant. I have in mind a young man whose father had met with reverses. The lad having to go to work, applied for a position in a printing office and earned $1 a day until work was slack, when he was told he was no longer needed. Then he went to a mill town and got a job at $30 per month as a loom section hand in a cotton mill. The mill shut down for the summer, so the young man was out of a job again, but in his trying for work we next find him in the position of roustabout in a gas plant.

This, as it eventually proved, was the beginning of his career. Seeing that there was a great opening in the gas manufacturing business for an energetic young man, because of the remarkable extension of the business due to the application of gas for cooking, heating and other purposes in addition to the lighting, he observed the many new forms of lights being introduced by which common house gas could be made exceedingly brilliant. He decided to follow the gas manufacturing business and worked hard at the different lines of occupation allotted to him. At times he was in the machine shop where gas making machinery was in process of repairs; again, he was engaged as helper in the fireroom. At one time he assisted the man in charge of a new gas device invention and experimental department. Then he helped at the book accounts at the end of the month and got a good insight of the business. He purchased a number of books concerning the installation and operation of modern gas manufacturing machinery, studied gasholders and gas machinery of all kinds

and, in a short time, was quite familiar with the same. He devoted as much time as he could spare to a study of the most modern systems of gas cooking ranges. Gas heating and lighting devices had to be carefully examined, and all the different parts composing the mechanism of the same fully understood, for our friend wanted to become an expert salesman of modern gas appliances as well as a seller of gas to consumers.

The most successful companies handling products for the markets attribute much of their success to the fact that they first take their salesmen into the manufacturing departments where they are taught the mechanical part of making the product. Hence, when these salesmen get out on the road, they are able to drum up business by telling patrons every detail concerning the merits of the article handled. The same idea is applicable to the success of the gas salesman.

Then, again, one must remind the aspiring man, who would sell gas or gas appliances to the public in these days, that he must be well up in modern methods of business. To get at the basis of this, he must study people, and should familiarize himself with the character of the persons with whom he must deal, for he has to approach the customer just right.

I know salesmen who enter into social life as much as possible for the purpose of getting into touch with parties with whom they wish to deal. Sometimes the social meeting is at the church; again, numbers of calls are made at the business place of the party selected before any mention of actual business is made. In addition to the study of character, it is advisable to study markets and prices, for one should keep in touch with values of industrial things, and visits should be made to public buildings with a view of observing where chances exist to install the lights or appliances made by his company.

I could mention numerous instances in which smart gas and gas appliance salesmen have placed good orders by simply travelling through the country and looking for chances to install certain lights or appliances where needed. The bright drummer for gas appliances often builds up his business by explaining to persons where there is a chance to install certain labor-saving gas devices. In a laundry, for example, one agent for a gas lighting appliance company noticed that a number of the operatives worked to disadvantage, because of the darkness of the apartment. He recommended that his company's system of gas fixtures be installed, with the result that the department was better lighted and the superintendent of the laundry satisfied.

Shops, mills, houses, in fact all kinds of places, can be visited by the energetic salesman of gas appliances with good results if he is active. And the men should be shown that the successful salesmen of gas appliances ought to study the economies of the business. Plant economy can be left to the men who are in direct charge of the mechanical end of the business; but the economy of distribution, and the placing of new goods with parties, have to be done with some degree of economy, otherwise the profits may be nil.

I know a party who sold a lot of gas appliances for a certain works, only to find in the end that there was a dead loss in the deal, owing to the expense of effecting the sale.

The study of economy and study of business systems will help the salesman a great deal, and he should be conversant with systems of advertising, so as to get the facts concerning the merits of his company's products before the public. Finally, the gas appliance salesman ought to be up in the matter of collections. I know of many many instances of goods placed by salesmen who forced business to their sorrow, because of their lack of foresight in looking up the party to whom the goods had been sold. If you let goods go to unreliable people, for the sake of making a good showing on the sales' slips, then you are taking chances. I know numerous instances of losses due to carelessness on the part of travelling agents, so it is necessary to look up one's customer in a business directory.

These points may be serviceable to young men desiring to engage in the selling of gas or gas appliances for gas companies, in which direction there is a very large field open for good men to earn good commissions. Gas heating and cooking devices are increasing in demand with the improved styles of such appliances, and the business promises to boom for many years, even in greater degree than it has been boomed.

AT the annual meeting of the Milford (Mass.) Gas Light Company, the annual election resulted in these selections: President, Clifford A. Cook; Treasurer, B. E. Harris; Secretary, H. A. Brown.

The Qualities for Success in Engineering.[1]

By DR. IRA N. HOLLIS, Professor of Engineering, Harvard University.

A few years ago I asked an old friend, who was manager in one of our largest industrial corporations, what technical school sent him the best men. He answered, "I may surprise you when I say that some of our most careful and reliable men come from the Worcester Polytechnic Institute." He did not surprise me, but he did give me a lasting, friendly interest in this school, based upon that best of all methods of building up interest and friendship, a good clean record. Hence, when your President invited me to deliver the commencement address, I rejoiced in the opportunity it gave me of paying my tribute of respect to the faculty of this institution for their excellent work and to the governing board for the maintenance of conditions under which that work can be continued, and of suggesting in a very small way the means by which graduates and students can alike add still more to the reputation of their Alma Mater. Besides, it is always a pleasure to meet young men of my own profession and to congratulate them upon the completion of a serious task well worth doing. I, therefore, address my words particularly to the graduating class in the hope of conveying to them my good wishes and my help on the way to success in their professions.

The most interesting event in a young man's life is his graduation from college, and the most interesting thought on the day of graduation is his prospect of success in his chosen career. Commencement day marks the change from boyhood to manhood. The school days are past and the time has come when the boy must be measured against men. There is an uncertainty about the outcome that seems depressing at first, or until after the struggle has really begun, much like the feeling that precedes any great crisis. Yet the young graduate may be sure that a place is always waiting for a serious-minded, hard-working man. He can take courage in the fact that other young men have tried it before him and have come out victors in the hard competition of modern life. Those trained in engineering will find so many ways open before them that it will be hard to choose. They cannot predict just what they will do, or what specialty will furnish them a life's work. The riddle is, therefore, doubly difficult for them, as they must find an answer not only to the question of success, but also to the direction in which success will lie. For this reason, in a school like this, a discussion of the qualities which help to a successful career is always timely, notwithstanding the fact that the subject is as old as human history. Every man must eventually find the answer for himself, and there is no better help than the study of other men's lives and of the qualities that have carried them through the trying years of their apprenticeship. We sometimes think that the twentieth century is somehow different from the long past centuries and that different qualities are needed to carry one successfully through a life's work. Not only is this not so in the homely affairs of daily life, but it is not even true in the ever-changing, most modern profession of engineering. The difference is only in the externals. The fundamental principles are always the same. Perhaps one important advantage, that we moderns possess over those who lived twenty centuries ago, is that a far larger fraction of society can recognize the true principles of success when clearly stated. Otherwise we are no better off than our remote forefathers.

It would be vain to try to say anything new to you who are graduating from this institution. Your technical qualifications have been the thoughtful care of your teachers. My only hope, then, is to give you an engineer's conception of what success really is and of the qualities that will enable you to achieve it. There are three aspects of success in life:

1. The power that comes with the possession of large means or the control of great forces.
2. Social prominence.
3. Service to mankind.

Which of these is a just measure of success to you gentlemen who are leaving school well fitted to begin learning your professions? It is unfortunate that at the present time the development of our material resources has obscured the answer to this question. We live in a nation of high ideals and great moral purpose. It is a common maxim that our people will finally vote right on any question, yet we are not always quite sure of its truth.

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1. Address before the Class of 1910, Worcester Polytechnic Institute, at the Commencement Exercises, in Tuckerman Hall, June 9, 1910. Reprinted from the *Journal* of the Institute.

The advance of the nation is like the swing of a pendulum which sometimes moves backward. Since the civil war the whole tendency of our social life has seemed to be in the direction of a money standard for everything; even the success of a writer is judged by the circulation of his books, and the influence of a school or college measured by its wealth and the number of its students. The sense of relative values has changed within the lives of most men who have reached 50, and the whole country now seems to be given over to a purely material struggle, in which the resources are being wasted quite as rapidly as they are being developed. You cannot, therefore, begin your career under ideal conditions. You will have to start under conditions as you find them, not as you wish them. It is well, then, to set your own standards now while you are young, and while doing it, not to be deceived by the loudest voices around you. The unrest of our people and the false money standards which strike many foreigners as characteristic of America, may, after all, be only a surface disturbance covering the depth of moral purpose below. I am fully convinced that this is true and that the real tendency of the times, in America at least, is towards simpler and better things. In the hearts of our people—that is, down below the daily newspaper—success has no relation to the acquisition of great wealth; it is, quite the contrary, measured by a man's service to his fellowmen. The wider that service to the community, State and nation, the greater is the respect and esteem in which a man is held. In many cases he must die before the extent of his service can be justly estimated, and if that service has been unselfishly given, his memory is certain to be a happy one in this country. Hence, I have taken as the basis of my subject this morning, success in its higher sense as measured by a man's willingness and power to serve others. The power to serve lies within one's self and demands a rigid determination not to be carried away by unessentials. Among these unessentials is a very large income. There is no intention here of making a sweeping condemnation of men of large fortunes, many of whom have served honorably the communities in which they have lived. One of the best signs of the times is the tendency to regard a large fortune as a responsibility in the interest of the public. The many large gifts to education, to medicine, to science, are evidence that the pendulum is swinging away from materialism towards the higher ideals that have always been at the root of American life. You have, then, no reason to lose courage or cheerfulness because some companion is going to pass you on the road to wealth. Your measure of success must be service to others. If there is any profession which can be singled out in New England as pre-eminently successful, it is that of the teacher whose life is spent in preparing others for their work, and yet it probably brings the smallest return in money. The teacher's chief satisfaction is in the success of his students. You, as you learn by experience, will come back to this school as the place of ideals where only the truth counts.

One of the best means of keeping one's courage in the disappointments and failures that must come to every human being, is found in the lives of the great leaders in the occupations of peace. I make a distinction between the occupations of peace and those of war because for centuries the heroes of war have occupied a disproportionate share in our literature, in our memorials and in our monuments. You can, by reading and studying a few lives, gather inspiration for your own struggles, and you cannot do better than to have by you the life of some great man who has contributed materially to the welfare of mankind. Two such men only recently passed away, and they so aptly illustrate the power of service, and the result that springs from it, that my entire address might profitably be taken up with their lives. A very brief synopsis, however, will direct your attention to them and will point out the qualities which gave them and must give all men success in their professions. You cannot do better than to read their biographies. One of them is Louis Pasteur. Born of poor parents, in 1822, his life was spent absolutely and resolutely in the service of others without a thought of money return. After long and constant study he became professor of physics at the Dijon Lycée, although by training a chemist. He afterwards went to Paris where his whole life was devoted to the study of forms too small to be seen by the naked eye. He gave us the foundation on which the study of microscopic life has been built up. As one of his contemporaries has aptly said, he raised the veil which for centuries covered infectious diseases. His whole theory of life was constant work in the service of mankind, and he died poor. The great monument erected to him in Paris, even before he had died, is sufficient evidence of his astounding success. He had, by incessant work, without thought of self, contributed more to alleviate the suffering of humanity than any other in history. His great success is said to have been due to his ability to seize at once upon the essential points of a question and to direct his attention to them without allowing his time or energies to be frittered away on side issues. On the marble which fills the arches of the Pasteur Institute is the following inscription:

PASTEUR.

1848. Molecular dyssymmetry.
1857. Fermentation.
1862. Generation called spontaneous.
1863. Diseases of wine.
1865. Diseases of the silk worm.
1871. Study of beer.
1877. Infectious diseases.
1880. Vaccines.
1885. Prophylaxis of rabies.

Any of these was enough to leave a man enduring fame in scientific research.

Another man much nearer to the profession taught at the Worcester Polytechnic Institute was Ernst Werner von Siemens. He was born in 1817 and was one of a large family. He went to Berlin, in 1834, for his education in a Prussian military school, and there began a life of singular romance. His *Personal Recollections* is better than any novel, the chief characteristic of his career being incessant activity in one problem after another, and with it all a certain ideal of service. Amongst the curious events of his long life was an amusing incident after he had served as a second in a duel. This occurred when he was 23 years old. He was condemned to a half-year's confinement in the citadel of Magdeburg, where he carried with him chemicals to study the electric deposition of metals. There he achieved his first success, which was in plating a German silver spoon with gold. The process sold for 40 Louis, and he thus acquired means for making further experiments. In the midst of these he was pardoned by royal decree, and on asking to be allowed to remain in the cell for a few days to complete his work, he and his effects were incontinently turned into the street for this sign of ingratitude to the king.

One of his great industries was the laying of telegraph and cable lines, and in 1866 he invented the armature to which his name has been given—the underlying principle of dynamo electric machinery. Thus he became the father of modern electrical engineering. While leading a simple and unostentatious life, his success laid the foundation of a great fortune and a world-wide industry which engages the thought and occupation of many thousands of men.

But, it may be said, these two men were geniuses and the ordinary man cannot hope to achieve anything like such results. The pressing need of every youth is to make a living; he must think of a money return, however much he might like to live the ideal life of service to others. Let us consider the whole subject from that point of view, and we shall find that even with the humblest of us the power of service is the greatest factor of success as it was with Pasteur and Siemens. Indeed, the power of service to others as a cold, selfish policy for the regulation of one's life, holds out the best prospect of success for the average man, even in a money return, not to speak of the happiness and peace of mind that come with it. The man who is most serviceable has by far the best prospect in every walk of life; that is, most serviceable to his employer, to his neighbor, and to the community in which he lives. Even in a larger way the directors of our great corporations are coming to recognize the value of service to others, to their employees, and to the public, as the best method of increasing dividends. The old habit of treating the great industries as the property of a few individuals who could do with them as they like, has passed, just as that point of view which regards the individual as wholly independent of his fellows must in its turn pass.

There is a widespread belief that modern industrial and social conditions do not offer the same incentive to individual initiative that our forefathers found in the struggle against the wilderness, and that our fathers found in the smaller industries. The argument is a perfectly familiar one: The great combinations in which the smaller industries have been swallowed up, afford openings for only a few highly paid men, while they have in effect reduced to the ranks a very large number of men who would, under other circumstances, have risen above the average. In other words, the modern industrial army has places for fewer officers and for a much larger number of privates. The truth of this belief has never been adequately investigated. It is in part based on theory as to what natural result would follow the absorption of a number of small concerns into one great trust having the power to dictate prices and wages. One small

industry after another has succumbed in this way; indeed, combinations seem to be the tendency of the times as the growth of transportation has reduced the size of our country and of the earth—combinations of everything, even of States. We find in our own case that our own country has, since the civil war, followed the tendency of the times by gathering federal powers at the expense of the States.

The large combination is supposed to demand more of its officers and less of the rank and file, and the theory that individial initiative is lessened, seems on first glance to be sound; but when the practical or actual experience of most of the older graduates is examined, one is not so sure. In my opinion there has never been so great a reward held out for the successful engineer, in a money return, in the power of service, and in the satisfaction which springs from the honorable practice of one's profession. There is hardly a large company in the country that is not in search of first-rate men. The number of highly successful engineers is far in excess of that of even 30 years ago; one is tempted at times to wonder where they all come from, and still more, where the money to pay them comes from. The problem of success then, for you, is far more intimately associated with qualification than with opportunity; the opportunity is always there and your main duty is to provide the fitness to take advantage of it. In discussing the qualities necessary to give an engineer success in life, it is not necessary to repeat the Ten Commandments; those have been learned at home, and for success in one's profession something more is necessary.

The first consideration for every man beginning his life's work is health. So many illustrations of this rise up before men who are past 50, that they are puzzled over the dullness of youth that does not perceive it. I recall the homely reply of an old officer in the Navy many years ago, when I asked him what contributed most to an officer's success in the service. He answered, "A good stomach." That struck me at the time as a rather inadequate and narrow definition, but its soundness and philosophy have impressed me more and more as I have gained a better understanding of success and efficiency. It is absolutely imperative that a man should keep his health and cheerfulness if he expects to do his best work. Let us have no illusion on this subject, however. It is not necessary to belong to some active athletic organization to remain in good bodily vigor; moderation in eating and drinking and even in exercise, together with some cheering amusement and plenty of work, are enough.

One of the most powerful elements in a young man's career is the sense of achievement; that is, the consciousness of power to carry through what he undertakes. This fact has been made of great use even in the education of children, especially of those who are not quite bright. The work given to such children usually takes a tangible form where they can see the result and perhaps find it of commercial value. There is nothing else that stimulates the energies of a boy so much as the effort to produce something that someone else wants. We often see that in the easy progress made by graduates when they are placed in positions of keen commercial competition. It is unfortunate that our modern colleges have not been able to make greater use of this principle in shaping their courses. One of the reasons why intercollegiate sports have taken on such a disproportionate value as compared with study, is the sense of exhilaration and of doing something in competition with others. It almost seems at times that many students gain more from their athletics than from the average course. Fortunately for your school, this is not true of technical or professional schools where the courses have a definite aim, and where the students can see the results of their work in the laboratories. What is true of the individual is also true of organizations. No one can estimate the benefit to be gained by achievement, individually and acting in concert with others.

The great cruise of the battle ships around the world gave our navy a sense of power that has doubled the value of the fleet; the officers and men know that they can handle the ships, machinery and guns without fear of break-downs and mistakes, and they know it because they have done it. One of the best stories of the Spanish war is that of an incident which occurred on the "Oregon" during the chase of the "Colon" at the end of the battle of Santiago. The chief engineer of the ship found his men giving out, after their long watch below, and he feared that the ship was losing speed in consequence. He asked the captain to fire the forward 13-inch gun by way of heartening up the engineer's force who were down below and could not see the result of the action. The captain very promptly gave the order and the boom of the gun was worth another half knot of speed, for at once the men knew that they were accomplishing something and that their ship was being brought into action again. There is nothing better in the world than such a sense of power, and you will find that every task carried to a successful conclusion will add to your strength to do more. It is like practice in a gymnasium or on the athletic field. Furthermore, when you come to direct the work of other men, you will find that by keeping them informed and encouraged in their work, you will increase by a very large percentage the amount of work done.

One of the most striking qualities possessed by successful engineers and also by successful men in other professions, is a sense of proportion. It is the power of selecting the essential points upon which a great undertaking or problem depends. Every problem turns upon some crucial point. This applies to industrial processes as well as to small problems set for the college examination. The man who has the power to seize upon them and state them clearly in his own mind is always a success, unless there is some radical defect in his make-up, while the man who cannot distinguish the relative importance of the different parts of a problem is generally a failure or the routine man whose time is directed by other men. The sense of proportion is what makes a great general, a great lawyer, or a great engineer. To some extent it is born in a man, but it can also be learned by industry and experience. It can rarely be taught in our schools because the subjects given there cannot well be classified according to their importance, and if they could be, the students would generally neglect those studies classified as of relatively little importance in the profession. As a matter of fact, all studies are of equal value in teaching a man how to apply himself, and yet when they are put into a curriculum for engineers, from the point of view of equality of value, a student will graduate without perspective. I should add here, in connection with the sense of proportion, that a problem clearly stated in one's mind is more than half solved, and that is also true in practical life after graduation from college. You will find in 9 cases out of 10 that a clear statement of what you wish to do will point the way to doing it.

The chief advantage that a graduate from college should have over a man of limited education is the power of mental application. His whole course at school has had that end in view. If a distinction between information and mental training can be drawn in a college course, the latter is by far the more important. The acquisition of information has a certain value in education, but that value can easily be overrated. After all, it is the power to think and work that a student must acquire if his education is to have any real meaning. This power is acquired better by hard and often disagreeable work on principles or fundamentals, rather than on facts. Here is where our modern system of education is a partial failure There are so many things to know that a man who starts out to get a general education is likely to scatter himself over a wide range of subjects, many of which do not add to his mental power. They may stretch the mind to a greater capacity but they lessen the power of concentration. For an engineer, hard concentrated work on some fundamental subject like mechanics is of far more value than scattered information on many topics. You will often hear the term "broadening studies" in connection with the colleges, but it does not require much reflection to convince a reasonable person that no one profession has a monopoly of breadth. Subjects that take one's mind away from a consistent plan of work are not broadening. The true measure of breadth is the power of service. If a subject given at school will better enable a man to understand and serve others, it is worth taking; if it will not, time spent on it is wasted. I do not mean that a student's time must be given wholly to strictly professional subjects. You gentlemen who have been educated in a technical school which would ordinarily be called narrow by the larger academic institutions, will have nothing to fear in contact with other men if you will only learn to understand them. You have only to keep to your work, to take an intelligent interest in the daily affairs of your community, and to enhance your power to serve in order to finish with a broad education.

One of the principal criticisms against our engineering schools is that the English written by the graduates is generally very poor. From my own observation the fault goes deeper even than poor English—it is a lack of power to write a concise, accurate report on any engineering subject. This deficiency tells so strongly against a young man's success that he cannot afford to treat it as one of the unessentials. He must learn to observe accurately and to write well. That is a qualification necessary to every engineer to-day. Fortunately, it is something than can be learned by practice and study of other people's writing. The mere consciousness of a de-

ficiency in this direction will go far towards correcting it, if one can only realize the value of brevity consistent with clearness.

The belief is very general that the graduates from technical schools are deficient in that indefinable quality which gives the power of directing in a large way the work of other men. There may be a certain truth in this claim, although it has not been proven. Only two of our schools educate all their students to direct the work of other men—the Military Academy at West Point and the Naval Academy at Annapolis. They exist for the avowed purpose of preparing all of their graduates to hold positions of command. All other schools in this country, colleges, technical schools and universities, are on a par in this respect, and there is very little choice amongst them from the point of view of learning to command men and to control their time. They certainly give their graduates a great advantage in the larger outlook and better mental training, but the notion that one programme of studies is to be preferred to another in the preparation for executive work is a fallacy. It is difficult to see why a young man who has studied languages and literature and all the other subjects closely related to the humanities should be any better prepared for executive work than one who has studied applied science. In fact, he is really not so well prepared. There are five methods of learning to direct the work of other men: First, severe discipline under military conditions; second, disciplinary study and work in laboratories; third, contact with a large number of fellow students and a daily share in student affairs and government; fourth, experience in large industries and private or public construction; fifth, knowing one's business or profession better than anyone else knows it.

The first of these can be taught only in a government school where a commission is held out to every graduate, because the average man can be drilled into effectiveness for command. The second is found in the technical schools and universities where men are trained for the engineeriag profession. The third represents the chief advantages possessed by the large universities over the smaller colleges and schools, and it is a real advantage to have learned when young how to live with other men, to respect their points of view and to rid one's self of narrowness and prejudice. The fourth is the apprenticeship stage through which every engineer must pass, and the fifth lasts all through a man's life. The last two are the most important, no matter how narrow or how broad a man's school training may have been. His education is never complete and his success depends upon continuity of effort.

There is no first-rate basis of comparison between the older universities and the newer schools of engineering. We must remember that while engineering as a profession has existed for centuries, it has taken its place only recently as an important profession for which a long training is necessary. Consequently our technical schools are not yet old enough to have formed the time-honored traditions that will become part of the equipment of their graduates. The only two that extend back to the early part of the nineteenth century are West Point and the Rensselaer Polytechnic Institute. Both have demonstrated beyond question the ability of their graduates to fill large positions as technical and executive officers in our industrial army. The true test of a man is what he learns after leaving school, and the traditions of a broad-minded, generous school cannot fail to set him on the right track, just as the contact with narrowness and meanness in any school must as surely hold him back. The sense of achievement counts as much in a school as in the individual.

Comparisons, therefore, are unsatisfactory for the same reason that a youth cannot in fairness be compared with a man in the prime of life. You need have no fears, then, when you begin your apprenticeship, if you hold fast to the idea that you have much to learn from the point of view of your profession and of the knowledge of mankind. Every young man, both as student and graduate, should, however, take warning against that fatal tendency to judge the value of studies from a purely personal and commercial standpoint, fatal alike to scholarship and to a true success in life. "What will this subject benefit me when I begin my profession?" is the question too often put to a teacher. All of us know that a profession must be learned before we can make a living by it; but the too close scanning of a school course, with a view of cutting out everything not absolutely necessary is extremely narrowing. The marked tendency of the times has been towards this small view of college education, wherein many young men have missed one of the greatest joys of school life, the pursuit of study from the pure love of it. It seems to me, then, that in choosing studies to help us in our service to others, we must avoid a too narrow basis of judgment, and that at school and after graduation we must seek the stimulus of things that will make us better men, in addition to those technical studies that will make us better engineers.

One of the discouragements ahead of a young engineer is the difficulty of choosing a specialty in his profession. If he has been educated in a narrow specialty his perplexity may be even greater, as there may be no place for him. His chief concern while young should be for a broad foundation, giving him contact with as great a variety of practice as possible. Then he will have no cause to fear his choice. Anything he may turn his hand to will be related by many points of contact to the broader experience in school and in the first few years of the field and workshop. A graduate is wise to begin his career in a real apprenticeship where he can spend 3 or 4 years, otherwise he will miss an essential part of the training that he can never make up later in life. It is just during this period of apprenticeship that a man requires courage and philosophy while learning obedience to orders and the subordination of self in what might be called united action or team play. There is an important difference between engineering and the other professions in this respect. They all involve more or less co-operation, but engineering has all the characteristics of an army. It demands always obedience and loyalty, without which many undertakings have failed. Furthermore, a young engineer depends for his advancement almost entirely upon the goodwill and good opinion of men in his own profession. It is their judgment that he must satisfy, not the loose opinion of clients. His success will, therefore, in the beginning depend upon his loyalty and devotion to the interests and wishes of others. If he can carry out without deviation the directions of his seniors, he cannot possibly fail in his career.

There are in all professions two kinds of men; those who do their work without excuses and those who have excellent excuses for not doing it. This world seldom takes much account of explanations and few employers care to listen to the reasons why an order has not been carried out. The man who is not afraid and is willing to go through with a disagreeable task can always be depended upon to do the work given him; while the man who lacks faith in himself will almost invariably permit himself to be turned aside by circumstances or by what he calls bad luck. As a matter of fact, failure to do one's task is generally due to insufficient attention or preparation. This simply means that the quality of concentrating one's mind on what is before one is of enormous importance to the young engineer. He must succeed in doing the work demanded by his employers both for the sake of his reputation and for the moral effect upon himself.

The knowledge of the details of the engineering profession comes with experience. No school can afford to take up much time with technical or conventional methods better learned in commercial practice. Language and the principles of applied science are too valuable to be shortened for such matters. Consequently, every graduate from an engineering school is only fit to begin and it is well for him if he knows it. The first 3 years form the most wearisome part of his career. He must be prepared to do work personally desagreeable and tedious. It is during this period that many men fail through a lack of courage and perspective. Consequently, the willingness to do cheerfully what is disagreeable is one of the most valuable attributes an engineer can possess. It is certain to give him the good opinion of his employers, and he is sure to end in taking a pleasure in his work. If anyone were to ask me what will give a man the greatest happiness on this earth, I should be tempted to answer, "Work that he has learned to like."

As you grow older each one of you will form for himself a theory of life; some high hopes will have cooled and you will have learned when you reach 50 to reconcile yourself to that measure of success which the world has given you In that theory of life two influences will play the strongest part; the memory of your home and the memory of your school; not as they actually were but as your memory brings them back to you. I recall going many years ago from the coast of Palestine to Jerusalem The road was a hard one and I walked all night. While I know now that at that time my feet must have been sore and my forces spent, the only thing that survives vividly in my mind is the picture of the sun rising over the Mount of Olives and lighting up with its rays the City of Jerusalem and the hill where Christ was crucified. It will always typify for me a certain ideal. And so in your lives the two memories will come back to you in every struggle that you will have in this world, and they will always be the ideal stripped of all discordant elements. In the years to come, the thought of your school can never be less than a refreshing and strengthening memory, and it is the ideal that will last—the school as you remember it, and not as it may actually have been. So long as you hold this ideal before you the small imperfections of this place where you have received the most important part of your education will be as nothing; even the buildings and surroundings will fade away before an ennobling and cheering ideal in which your school days will seem enshrined. If you live up to this ideal in the true service of others, you cannot fail to be successful in your professions and influential as good citizens.

Night Lights.

[Prepared for the JOURNAL, by MR. GILBERT MULOCK.]

During the past few months the writer has had occasion to view a number of new installations of outdoor inverted gas arc lamps; and, be it said to the calamity howlers, that there is always something nearly new under the sun. Further, that in this case, not unlike the latter, whenever the versatile and verbose arch-enemy brings forth new weapons with which to conquer, the gas lamp manufacturer generally goes him one better, though, to be sure, it is unfortunately true that neither ourselves nor the world hears quite so much ado about it, such be the ways of advertising in the ranks of the two darkness-defying giants.

One of the more recent installations of this new weapon placed in our hands was shown at the Alexandra Rink, Hamilton, Ont., on the occasion of the recent meeting of the Canadian Gas Association, which was held in the building named. Both day and night views of the installation are shown in the accompanying illustrations.

Fig. 1.

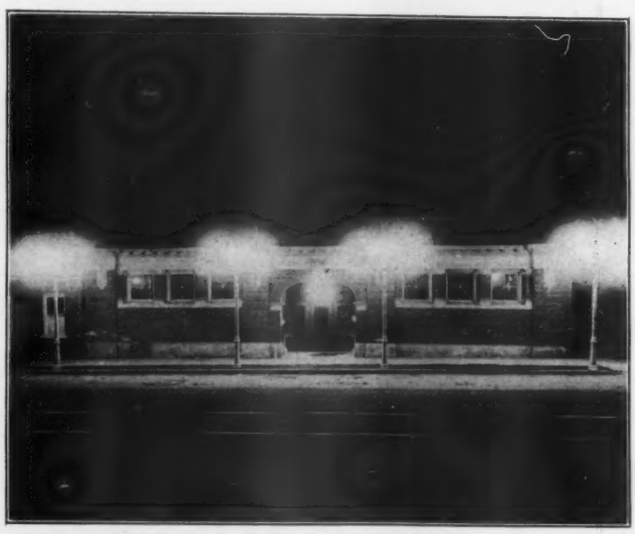

Fig. 2.

A mere cursory glance at these two pictures brings to our minds a host of suggestions. Public lighting by gas, street lighting fixtures and photography being the more prominent. Under the first caption let us see the status of that commodity in this country. As to number, in the larger cities, it has a considerable lead over electric public lighting, while in the smaller cities the reverse is the case. As to the area lighted it runs a poor second, owing to the preponderance of electric arc lamps, the gas lamps being almost exclusively single burners. Here we have the opportunity to push large units for outdoor lighting, just as they have been successfully pushed for use indoors, which brings up the matter of street lighting fixtures. The Hamilton, Ontario, installation consists of four posts each equipped with two Humphrey outdoor arcs, and this twin arrangement has many points of advantage over the one lamp per post type; the first being the large volume of light necessary for large area and spectacular lighting; and, secondly, the smaller outlay involved for posts, connections, etc. When considering the installation of these fixtures in competition with the wooden pole, overhead-wire electric, the battle is almost won on account of appearance. Secondly, the light is absolutely steady.

In order to show the reader the lighting effects resort must be had to photography, and here, unfortunately, the camera fails. While the effect of the night picture might be termed "pretty," it utterly fails to portray the daylight effect which is produced. Instead of there being a narrow band of light under the lamps, the whole street is brightly illuminated. The main reason for the difference between the effect produced by the camera and that upon the eye is largely a question of time and a further reason being that of color.

Bureau of Mines, Department of the Interior.

The act establishing a Bureau of Mines in the Department of the Interior, approved May 16, 1910, became effective the 1st inst. As originally approved, the law contemplated the transfer of the entire technologic branch of the United States Geological Survey, the mine accident investigations, fuel investigations, structural materials investigations, the entire personnel, property and equipment, to the Bureau of Mines; but the sundry civil appropriation act, approved June 25, amended the law to such an extent that the structural materials investigations, including the personnel and equipment for these investigations, went to the Bureau of Standards, Department of Commerce and Labor.

Carrying out the spirit and intent of the law so amended, the Secretary of the Interior has transferred to the Bureau of Mines the investigation of mine accidents and fuels, together with the personnel and equipment of these investigations, and has transferred to the Bureau of Standards the structural materials investigations and the employees of the technologic branch of the Survey engaged in these investigations. The fully equipped testing station at Pittsburgh also goes to the Bureau of Mines.

The Bureau of Mines, therefore, includes the mine accidents and fuel investigations for which an appropriation of $410,000 was made by Congress. The total appropriations for the Bureau, including salaries, rent and expenses of removal, amounted to $502,200.

The work of the Bureau of Mines, for the first year, will be a continuation and expansion of the work carried on by the Technologic Branch of the Geological Survey. The law in itself provides for a variety of other problems that properly belong to the Bureau of Mines, and which should eventually be undertaken, such as methods of mining and metallurgical processes; but these activities will be deferred for the most part until Congress gives additional authorization in the shape of adequate appropriations. The spirit of the debates in Congress, both on the Bureau of Mines legislation and on the appropriation items, emphasized the desire to regard the mine accidents investigations as urgent, and this will be the feature of the work.

In all, $310,000 was appropriated for mine accident investigations. Of this sum, under the general plans approved by the Secretary of the Interior, $120,000 is to be spent on the rescue stations; $36,000 for housing nine stations; $34,000 for equipping eight new stations; and $10,000 for additional equipment for five existing stations. The allotment for the investigation of explosives is $40,000; for electricity, in mining, $14,000; appliances for preventing mine accidents, $8,000; examination and codification of mining laws, $5,000; other technologic investigations, such as ore treatment, etc., $10,000. For the analyzing and testing of the coals, lignites, ores, and other mineral fuel substances belonging to, or for the use of, the United States, $100,000 was appropriated. Of this amount, $35,000 will be spent in the chemical and physical investigation of fuels; $25,000 in the inspection of government fuel purchase; $22,000 in fuel efficiency investigations; $5,000 in lignite and peat investigations; and $4,000 in briquetting investigations.

The mine accident investigations, which have been transferred from the Geological Survey to the Bureau of Mines, were first authorized in the legislative appropriation act of May 22, 1908, carrying for this purpose an appropriation of $150,000. This was followed by a similar appropriation carried in the act for the sundry civil expenses of the government for 1910. A mine experiment station was established in Pittsburgh during 1908, at which, since that time, investigations of explosives, coal gas, dust, electricity and other possible causes of mine explosions, have been continually under way. The mining engineering field force of the Geological Survey has already made decided progress in the study of underground mining conditions and methods. Practically all of the coal mines in which mine explosions have occurred during the last 2 years have been carefully examined, the gases, coke and dust have been analyzed at the laboratory at Pittsburgh, and every effort has been made to determine the explosibility of various mixtures of gas and air in the presence of shots of different types of explosives. Considerable progress has also been made in the investigation of explosives used in coal mining, and the conditions under which they may be used with least risk. Manufacturers have submitted many explosives for test at the station, and a considerable portion of them passed and classified among the permissible explosives. The investigations and educational work in connection with the use of artificial breathing and other types of mine rescue equipment, the so-called oxygen helmets, have not only been useful in developing a more satisfactory use of such equipment in the examination of mine explosions, but also better methods for using this equipment in mine rescue work.

The fuel investigations under the Geological Survey, and which are transferred to the Bureau of Mines, have already resulted in a better realization throughout the country as to the value of fuels.

One result of this work is that nearly all of the fuel now purchased by the Federal government is bought on specifications and subject to test by the fuel division, or purchased after examination made of the coal supplied by the mines from which coal is delivered to the government.

The publications of the Survey, relating to mine and fuel investigations, those prepared by the Technologic Branch, will in the future be distributed by the Bureau of Mines. The publications relating to structural materials will continue to be distributed by the Geological Survey. The last of the Bulletins of the Technologic Branch to be published by the Survey will be issued from the Government Printing Office about August 1. This Bulletin relates to the "Explosibility of Coal Dust," and was prepared by Mr. G. S. Rice, with chapters by Messrs. J. C. Fraser, Axel Larsen, Frank Haas and Carl Scholz.

The first of the Bureau of Mines Bulletins, the "Volatile Matter of Coal," by Messrs. H. C. Porter and F. K. Ovitz, will be published in the next few months. Then will follow "Coal Analyses," by Messrs. N. W. Lord and J. S. Burrows; "Final Data Regarding Steam Tests," by Mr. L. P. Breckenridge: "North Dakota Lignite as a Boiler Fuel," by Messrs. D. T. Randall and Henry Kreisinger; "Producer Gas Tests in 1905–1907," by Mr. R. H. Fernald; "The Coke Industry as Related to the Foundry," by Mr. Richard Moldenke; "Coals for Illuminating Gas," by Messrs. A. H. White and Perry Barker; "Petroleum for Combustion Under Steam Boilers," by Mr. I. C. Allen; which publications, when issued, can be obtained by addressing the Director of the Bureau of Mines, Washington, D. C.

Rulings Made by the New York Public Service Commission, Second District, in the Instance of Proceedings Instituted by E. S. Simpson, Geo. Reimann and M. B. Eshleman, all of the City of Buffalo, against the Buffalo Gas Company.

In these proceedings M. B. Eshleman initially made application to the Buffalo Gas Company for gas service in 1907. His premises are situated 135 feet from another street in which there was a gas main. The Company refused to extend its main to connect with his premises unless he paid $160 construction costs. Owing to the fact that other residents along the line have since paid proportionate charges and received gas, the demand of the Company upon Eshleman has been reduced to $25. This demand complainant has not met and the Company consequently has refused to supply him with gas. Reimann, upon application to the Company for gas service, was charged the sum of $25 for constructing a service pipe from the curb to his premises, a distance of 25 feet, the Company's mains being constructed to the curb in front of his property.

Simpson, upon application for service, was charged $17.75, the charge including the cost of construction of service pipe from the gas mains to the curb line and from the curb line to complainant's house. The questions involved and the rulings of the Commission are as follows:

1. What should be the practice of the Gas Company in installing a service for furnishing gas where the main is already in the street upon which the premises to be supplied are located and the premises are situated within 100 feet of the main?

The Commission cites Section 63 of the Transportation Corporations Law, which requires gas and electrical corporations to supply service to any applicant whose premises is within 100 feet of its distribution system, provided the ground be not frozen or such other objections obtain of a nature to present serious obstacles to making the extension, and further providing that the customer may be required to deposit a sum of money sufficient to pay the cost of his portion of the pipe required to be laid and the expense of laying such portion. It has been the practice of the Buffalo Gas Company to assume the cost for the pipe and the expense of laying same from the main to the curb, and to compel the consumers to pay the expense of running the pipe from the curb to the meter. The Commission rules that this division of the expense is entirely reasonable and proper.

2. What should be the practice of the Company where the main is already in the street and the premises to be supplied are situated more than 100 feet from the main?

In answer to this question the Commission points out that its powers as amended by the Legislature of this year are ample to require extensions of mains a distance of more than 100 feet. The Commission, therefore, will exercise such power provided the conditions under which it is possible to give the service can be shown to the satisfaction of the Commission to be reasonable. In event of disagreement between the parties the terms upon which such service is to be given should be prescribed by the Commission.

3. What should be the practice of the Company where the main is not in the street or has not been brought up to a point therein where it is within 100 feet of the premises sought to be supplied?

The same answer as to question two applies here. Application for extensions may range from a request to the Company to lay a main for 1,000 or 2,000 feet in order to accommodate a few scattered customers, to a request for a main through a short connecting street between old thoroughfares in a thickly populated district. In the latter case there is a fair prospect of immediate consumption of gas due to a rapid building up of the abutting property, while it may take a long time in the former case to attain a consumption which shall be fairly remunerative upon the proposed outlay; but in either case it is manifestly unfair that the consumer should pay for the extension of a main in the street which becomes at once the property of the Company without promise or prospect of reimbursement, no matter how large the consumption of gas ultimately may become. The gas should be furnished if the prospective customers stand ready to guarantee a consumption which will justify the outlay. Such guaranty may be in the form of a deposit, to be returned when the conditions of consumption are fulfilled, or it may be given by requiring the consumer to pay for the construction of the main with an agreement to return the amount paid through a credit on bills for gas consumed. The Commission is of the opinion that in any case where a canvass of the territory for which service is asked shows a probable gross annual income from private consumers of 20 per cent. on the cost of extension it should be made free of cost to the consumer.

4. What discrimination, if any, should be made by the Company in furnishing service to premises which are wired for electricity at the time of making the application?

This question arose by reason of the practice of the Buffalo Gas Company in installing service pipes from curb lines to houses free of charge in certain cases. The Company has made such free installation to consumers whose houses were not wired for electricity upon the theory that the Company could expect the use of gas exclusively upon the premises. This theory is pronounced fallacious, and the practice held to constitute a rebate to favored customers, which is no less a rebate from the fact that it takes the form of a gratuity. If any charge at all is made for service from the curb to the house it should be made to all alike in the first instance and rebated to all alike who actually use within a given period a stated amount of gas. The Commission rules, therefore, that the Company should either (a) desist from such practice and charge all consumers for curb-to house services; or (b) in case it elects to continue the practice of furnishing such service free, should formulate a rule for apportioning the cost thereof, which shall be based upon the gas consumed or to be consumed, and not upon the presence on the premises to be served of any other appliances for furnishing light or heat. The rule should be for all alike and should be based upon actual consumption rather than upon arbitrary or speculative conditions.

5. What should be the practice in regard to the charge to be made for installing the service to the premises in question should such a charge be deemed proper. Should it be an arbitrary and uniform charge per foot, or should it be governed by the actual cost of making the installation?

If any charge is made at all for installing the service pipe from the curb to the house it should be made at the actual cost of the work. The conditions of actual practice may develop the fact that an arbitrary charge per running foot is satisfactory to the Company and to the consumer, but in each case the consumer should be advised that it is his right to have the cost of the construction accurately determined and a bill of it rendered to him. The consumer may be required to make a deposit covering the costs, but should not be told that he must pay a fixed and arbitrary sum for installing the service, and that in default of his paying that sum he cannot get the gas.

The Commission has applied these general principles to the specific complaint cases in question, and will cause it to be served upon the Buffalo Gas Company in order to show cause why its regulations and practice in these matters should not be changed and rules adopted which shall be in accordance with the principles laid down.

Special English Correspondence.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, July 9, 1910.

The Gas Institute Meeting.—A Modern Installation of Gas.

The meeting of the Institution of Gas Engineers, which was held in London about the middle of June, was, in more senses than one, a good business meeting. At the commencement of his inaugural address, the President, Mr. James W. Helps, of Croydon, remarked that he intended to take the bold step of practically ignoring engineering subjects, and confining himself to the consideration of certain points connected with the industry, upon the true appreciation of which would depend the extent to which there would be engineering matters to interest the profession in future. Conditions were changing, and the question of how to dispose of 1,000 cubic feet of gas at a reasonable profit was more important than the consideration of the most economical way in which that quantity of gas can be produced. The President has in these words correctly portrayed the prevailing change of conditions. Fifty years ago the price at which gas was sold rendered it a luxury for the few, rather than a general commodity. Now it has been so far cheapened, not only by reductions in price, but by improved appliances that enormously increase the duty, either in the form of light or heat, that can be obtained from a given quantity of gas, that the cost does not tell against its use, and there is no longer a pressing need for studying questions of economy. Meanwhile there has been a great change in regard to touting for business. No one sits behind his counter now-a-days, waiting for customers to drop in, but uses methods to attract them, such as advertising, sending out circulars, and personal canvassing. And gas companies find that they must follow the regular custom, not so much because they are harassed by competition—the steady increase in the sales of gas year by year disposes of that idea—as for the obvious need of keeping in the swim. The figures quoted by the President are a case in point. After dwelling on the ever increasing difficulty of finding a profitable market, he goes on to show that the number of consumers in Croydon has increased during the last 20

years, from 6,291 to 35,644, and the quantity of gas sold, from 386 to 1,257 millions.

If one may judge from the programme of papers submitted for the consideration of the meeting, the members of the Institution are already acting on the lead of the President and devoting their attention to questions of supply and demand. Only six papers were submitted, and of this small number the ordinary list of members cannot claim more than two. Mr. H. L. Doherty and Mr. J. R. Klumpp sent contributions from the United States, and Mr. Jacques Abady dealt with the public lighting question from a municipal point of view. There were two papers on carbonization and one on the general management of gas works, so it cannot be said that undue prominence was given to engineering subjects to the prejudice of more important matters. There were the usual reports from the Research Committees. In connection with carbonization, Mr. J. F. Bell, of Derby, contributed some investigations with respect to carbonizing in horizontal retorts that practically constituted an additional paper, and might have appeared in the programme as such, and gone to improve the poor list. Any deficiency in regard to number of papers was more than covered by the toue of the discussions, which were well maintained and listened to by an excellent attendance from first to last. Altogether, the President and Council may be congratulated on a successful meeting, that has fully kept up the prestige of the Institution.

Opportunity was taken to hold, in the course of the session, a gathering of the Commercial Sections that are now become an established feature in connection with every District Gas Managers' Association. A report setting forth the objects of the Section, and the work at present being done or in contemplation, was presented and discussed at some length; but as a full report is not published, I do not feel at liberty to notice the proceedings further. The title indicates the nature of the work that is being energetically carried on by these Sections, and there is no lack of material for their labors.

The excursion on the last day of the meeting was unusually well supported, at least 50 per cent. of the members being present, and over 100 ladies. Several reasons combined to bring about this state of things, and the first that should be mentioned is the personal popularity of the President in the profession, apart from his exertions as an Hon. Secretary of one of the District Associations, and subsequently serving the Institution in a similar capacity. Then Mr. Helps is a man that not only preaches but practices, and it was known that the views expressed in the paper were something more than bare statements in pen and ink. They embodied the results of practical work at Croydon. The distance by rail enabled the journey to be accomplished in half an hour, thus avoiding the necessity for disturbing the ample repose that is required after 3 days' hard work at the business meetings, and at the same time, allowing those who wished to do so, getting home the same night. It is also well known that the Croydon gas works is one of the show places of the country from a gas engineering point of view. It was a long train, containing as large a party of gas people as have ever gathered behind one railway engine, that steamed into the gas works' siding at Croydon, and to judge from the excellence of the arrangements, the reception and catering for 600 people are quite an ordinary, everyday affair to Mr. Helps and his Directors. The party detrained at a special landing stage erected on the borders of the spacious recreation grounds belonging to the Croydon Gas Company, and were quickly arranged in companies for a tour of inspection. It need not be said that they found all the latest developments in gas manufacture and purification at Croydon, and a very interesting and profitable time was spent in examining coke conveying, storing and distributing plant, mechanical drawing and charging machinery, carburetted water gas plant, etc. The walk round was brought to a conclusion at the entrance to an enormous marquee, and the visitors were invited to sit down to an excellently appointed luncheon. The usual complimentary toasts having been cordially honored, the party rejoined the special train that was in attendance and were quickly conveyed to the Japanese Exhibition at Sheppard's Bush. After partaking of afternoon tea, at the invitation of Mr. and Mrs. Helps, the party broke up, and the majority passed a pleasant evening in participating in the fun of the fair.

Accepting the suggestion that it is more important to know how to sell gas than to know how to make it, the status and position of the individual gas manager, and also that of the representative Institution, stand in need of review, as regards adaptability to changed conditions. The manager is required to be something more than a gas engineer, and the Institution must take up a wider scope than is represented by the gas engineer's society which it at present claims to be. In the average provincial town, the manager's headquarters are at the gas works, and his first duty is considered to be connected with the maintenance of a proper supply of gas in accordance with Parliamentary regulations. If there is a town office and showroom for the use of customers, it is left in charge of a subordinate. Anything in the way of systematic advertising or exploiting possible new areas for business is conspicuous by its absence. It is usual to advertise in the local press and to keep a supply of catalogues and pamphlets for the use of inquirers—and that is all. But under the new regime, it is evident that the manager must delegate a large proportion of the details at the works, which at present occupy the chief portion of his time and energy, to a responsible foreman or works' superintendent, and take up his headquarters at the town office. Or an alternative scheme would be for him to retain his present environments, and to leave the commercial side to a new official who has been properly trained for the job. The average gas engineer cannot claim to have any special aptitude for arranging advertisements or canvassing schemes. There is a third proposition, and that is to carry on advertising and canvassing through the medium of united action, a number of companies combining together to support a competent organization. There is much to be said in favor of it. Individual effort in closely occupied districts must necessarily result in a great deal of overlapping. There are newspapers and periodicals that circulate in every town in the country. An advertisement inserted in a publication of this class can be just as well worded to apply to each and every undertaking as to any one in particular. Except in the cases of large undertakings, there is scarcely sufficient opening for the employment of a high class organizer and staff, nor can such acquire the experience that is rendered available by practising in several different districts.

The Institution of Gas Engineers must be extended to become a Gas Institution, which is a different thing, and is a large order. The anomaly of discussing commercial subjects, while gentlemen who devote their whole time to, and have specialized in these particular matters, are according to the rules ineligible for membership, must be ended. The progress in this direction has been much hindered in the past by a certain feeling of exclusiveness under which the benefits of membership are to be confined to managers of gas works only. If this position is to be maintained the work of the Institution should be limited in accordance. But if it is to become a real Gas Institution, membership should be open to chairmen of gas undertakings, secretaries, heads of distribution department, etc., etc. The Council are continually complaining of the lack of adequate financial support. Would not a board of directors feel more closely associated with the work of the Institution and, therefore, more inclined to subscribe to its funds, if the eligibility for membership included thereon four officials instead of one. And room should also be found for utilizing the valuable information acquired by the manufacturers of gas stoves and appliances, some of whom know a great deal more about "making a market" than the average gas engineer.

A new hotel has recently been erected at Newport Mon, and filled with the latest appliances for the utilization of gas as a means of lighting, warming and cooking. The lighting arrangements include a water-driven gas compressor for insuring a high pressure supply. The outside lighting includes 6 Keith lamps, about 700-candle power each, and for the inside there are 176 lamps, averaging about 150-candle power each, all fitted with by-passes, specially designed globes and fittings. For warming, there are 30 gas-steam radiators and 23 gas fires, mostly of enamelled iron colored to suit the furniture and surroundings. The culinary apparatus includes a hot water circulating boiler, two large washing boilers, hot closets and carving tables. steamers, fryers, grillers, etc., and the whole forms a valuable illustration of the capabilities of gas. The general arrangements were planned by the engineering department of the Newport Gas Company, who are to be congratulated on their enterprise. Evidently the gas interests at Newport are in good hands. Seeing that the high pressure system has now taken up important proportions in London, and is rapidly extending, it is satisfactory that the provinces also are claiming a share of the honors.

Items of Interest
FROM VARIOUS LOCALITIES.

In addition to the large space or area of factory ground now owned by the Cruse-Kemper Company, that corporation has purchased something over 2½ additional acres for the handling of present and future business. The purchase of this additional ground will be the only expense necessary for some time on house account, the equipment on machinery account being complete enough and up-to-date enough to take care of a large amount of work. It is pleasing to know that the business of the corporation warrants increases, and it would seem that Mr. J. A. Mayers made no mistake when he signed with the Cruse-Kemper folks. Meanwhile Mr. Cruse keeps on in the even tenor of his way.

Mr. Campbell W. Fair will assume his new field of duty, as President of the Atlantic (Ia.) Gas Company, about the 1st prox.

We regret to have to chronicle the death of Mr. Ross F. Bump, service supervisor of the Denver (Col.) Gas and Electric Company since 1900, who passed away in Denver the morning of July 7th.

The Finance Committee of the Flint (Mich.) Common Council and the proprietors of the Flint Gas Company, seem to have reached an agreement as to the rates which shall there prevail for gas during the next 5 years—under the Company's ordinance, a readjustment of the schedule takes place every 5th year: For the first 2,000 cubic feet, $1 per 1,000, and for all succeeding quantity, used in any single month, through one meter, 95 cents per 1,000. Under the existing or former agreement the net rate was $1.05 for gas used on lighting account, and $1 per 1,000 when used on heating account.

The authorities of Augusta, Ga., seem also to have reached a rate agreement with the Augusta Gas Light Company under which the latter will charge the flat figure of $1.15 per 1,000 cubic feet, the gas to average 18 candles in lighting value. It is also stipulated that the

authorities may at any time, without notice to or permission from the Company, test the quality of the gas being sent out.

JUDGE R. W. ARCHBALD has named the 10th prox. as the day for having a hearing to show cause why the bondholders of the Berwick (Pa.) Gas Company shall not be awarded a decree in their petition that an order to foreclose shall issue. Attorneys O'Malley and Warren, of Scranton, opposed the motion.

As a sequel to the meeting held about a fortnight ago by the Directors of the Washington (D. C.) Gas Light Company, this action was subsequently reported. It was authorized to call a meeting of the stockholders for September 26, when they will be asked to vote on three presentations:

1. That all future betterments shall be financed, as required by the issuance and sale of 5 per cent. bonds, the procedure of which shall be used exclusively for betterment purposes.

2. That the outstanding $2,000,000 6 per cent. certificates of indebtedness and $600,000 first mortgage, 4 per cent. bonds, aggregating $3,200,000, shall be refunded by the issuance of a like amount of 5 per cent. long-term gold bonds, thereby effecting an annual net saving of $20,000 on fixed charges.

3. That the dividends to stockholders shall hereafter be declared upon the par value of the Company's investment, and not as heretofore upon the face value of the Company's capital stock, now inadequately representing the same; provided said dividends, together with the interest upon the said bonded debt (fixed charges) shall in no event exceed in the aggregate more than approximately 6 per cent. upon the fair value of the Company's investment, meaning by an investment all of the property of the Company used in the conduct of its business for the convenience of the public.

THE Directors of the Louisville (Ky.) Gas Company have elected the following executive heads: President, F. M. Sackett; Vice-President, John Stiles; Secretary and Treasurer, Fred. A. Nobbe.

THE franchise granted the Indiana Gas and Electric Company, of New Jersey, to furnish artificial gas to the residents of Marion, Ind., on Sept. 18, 1908, has been declared forfeited.

JUDGE WEAND has rendered an opinion that the Montgomery (Pa.) Heat and Fuel Company is in safe repute in North Wales, and that the bond filed by the Company in 1907 is valid, wherefore, the Borough is enjoined against interfering with the Company's burying pipes in the streets thereof.

PAPERS filing the application of certain prospectors for the right to construct and operate a gas works in Matamoras, Pa., have been received by the authorities. This place is on the Delaware river at a point opposite Port Jervis, N. Y., with which place it is connected by a toll bridge. Matamoras was formerly noted as only a summer resort, but its natural situation has attracted the attention of investors, until now it has a permanent population of 3,000 or more.

UNDER the revised bid, made for the public lighting of New Albany, Ind., by the New Albany Gas and Electric Company, in so far as that is done by electricity, it is proposed to charge $52.25 per lamp per year, instead of $58.20, as now. This figure will rule provided a 10-year term is agreed upon.

WE are advised by those in concern that the plan of organization of the United Light and Railway Company, which is being effected under the laws of Maine, is soon to be effective. The named Company will take over the gas, electric light and railway properties hitherto operated by Messrs. Childs, Hulswit & Company—8 in number. The Company will be thus capitalized: First preferred cumulative stock, $2,132,000, six per cent.; second preferred cumulative stock, $865,500, three per cent.; common stock, $800,000, or a total of $3,799,500. Those caring to go further into the details of the procedure can obtain the desired information by addressing Mr. Frank T. Hulswit, President of the Childs, Hulswit Company, Grand Rapids, Mich. While taking leave of the subject, we may not fail to express the hope that as the Childs, Hulswit Company was so may the United Light and Railways Company be.

THE Columbus (Ind.) Gas Company has wisely extended its mains to East Columbus, a thriving settlement of 1,500 people situated just across the creek.

"THE capacity of the retort house of the Bangor (Me.) Gas Light Company is to be greatly enlarged; in fact it is to be brought up to where it can be depended on to send out 200,000 cubic feet per diem, and the purifying system will be rebuilt. While this may not seem much to the gas men of other and larger places, it is nevertheless notable to us, in that it represents a gain, on a percentage basis, within 10 years, of 75 per cent.—L. V."

"SOME evenings ago the members of the Commercial Department of the Spokane Falls (Wash.) Gas Light Company, assisted in a banquet and smoker in the Gothic room of 'Davenport's.' A. N. Cantril, General Manager of the Company, presided in excellent form, and delivered a short, though pointed, address, when the eatables and other things had been consumed and the cigars were lighted. Another well uttered 'few remarks' were made by Mr. Mr. D. M. Coughlin, who came here from Easton, Pa., to act as Commercial Manager. Following the set speeches a general discussion was had, the burden of which was how best to encourage the growth of the use of gas in Spokane Falls, under any and all accounts.—B. T. V."

CITY GAS ANALYST NAUMANN, who is in charge of affairs gaseous in Port Huron, Mich., and who has had charge of such for several months, has yet to make an unfavorable report, either in respect of candle power or heat unit value.

THE proprietors of the Standard Gas and Electric Company, of Raleigh, N. C., have awarded a contract to the Cruse-Kemper Company, under which the latter agrees to construct a storage holder up to retaining 150,000 cubic feet. The vessel is to rest in a steel tank.

THE Red River Power Company, of Grand Forks, N. D., has announced a substantial reduction in gas and electric rates, which notice is supplemented by the further one that improvements on the plant, to be made before the winter sets in, are being arranged for, which will involve an expenditure of $100,000, The Red River Power Company is the new title of the Grand Forks Gas and Electric Company, the properties of which were recently purchased by Messrs. H. M. Byllesby & Co., of Chicago. The principal improvements outlined include the installation of a 750-kilowatt engine generator unit, the construction of 20 to 25 miles of electric pole line distributing system through the residence district, and the laying of nearly 4 miles of new 4 to 6-inch gas mains. In the meantime, a working new business getting division will be organized to secure added business on wire lines and street mains. It is a noteworthy fact that practically there has been no electric lighting service to residence structures in Grand Forks.

A PETITION, signed by 171 citizens of Hudson, Wis., was filed with its City Clerk some days ago, praying that a special election be called to permit all voters to record themselves for or against the gas franchise adopted by the City Council in mid-May. The St. Croix Gas Company is the active agent in respect of that proposition, and the thought is to hook up Hudson, by means of a high pressure line between that settlement and Stillwater, the delivery proper in Hudson to consumers to be made under low pressure conditions by means of a holder located at the terminus of the carrying pipe.

AN amendment to ordinance 1119, under which it will be unlawful for the Oklahoma Gas and Electric Company to compel its patrons to put up a cash deposit to insure payment of bills for gas and electric currents distributed, is now before the City Council. The sum fixed upon shall not exceed $10, and the penalty for infracting such ordinance shall be a fine in amount not to exceed $100.

PROF. EDWARD A. BESSEY, of the Electrical Engineering Department, Colorado Agricultural College, died at his home in Fort Collins, Col., the afternoon of the 12th inst. Prior work of his was done in the works of the Stanley Electric Mfg. Company, the Denver Gas and Electric Company, and the Central Colorado Power Company. He was in his 35th year and was a graduate of the University of Nebraska. His father, Charles E. Bessey is a noted botanist and is prominent in the teaching roster of the University from where the son graduated.

THE Stacey Manufacturing Company, of Cincinnati, is constructing, in fact, is just completing a 500,000 cubic foot capacity, 3-lift holder, to set in steel tank, at Saginaw, Mich., and will speedily commence the erection of a duplicate construction at Muncie, Ind.

A SPECIAL election to determine whether or not a gas plant shall be erected in Belle Plaine, Ia., will be held early next month.

The Market for Gas Securities.

The main reason to which is traceable a decline of 3½ points for the week in Consolidated, in so far as we can note, is that the National Lead Company cut its dividend rates. Why such an effect follows such a cause is hard to reconcile with the situation as it exists; but there you are, National Lead cuts its dividend rate, whereupon Consolidated loses a couple of points. In consonance with the tune that we have been playing along for weeks, the actual facts favor a rise, but the theoretical fancies of Wall street bring about a decline. Consolidated opened to-day (Friday) at 132 to 132½.

Brooklyn Union is acting rather oddly at present, and it would not surprise anyone were its controllers to declare a substantial extra dividend, without great preliminary flourish. Peoples, of Chicago, is steady at 105½ to 106, and Lacledes are bearing up remarkably well despite the chill feelings that came to its owners over the readjustment of selling rates in St. Louis.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

JULY 25.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	131	132¼
Central Union Gas Co.—1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	155	165
New Amsterdam Gas Co.—1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98½	100½
New York and East River—1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	133	135
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106½	107
Yonkers	299,650	509	130	—
Out-of Town Companies.				
Bay State	50,000,000	50	¾	⅞
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.—1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	73	73½
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	106½	—
Mortgages, 6's	3,600,000	-	89	100
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100½
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,235,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis	10,000,000	100	99½	99¾
Preferred	2,500,000	100	90	100
Bonds	10,000,000	1,000	102½	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	79	80
Preferred	25,000,000	100	90	91
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	105½	105¾
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¼	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—1st Mtg. 5's	751,000	1,000	100	102
Washington (D. C.) Gas Co.	1,600,000	200	375	380
1st Mortgage, 6's	600,000	—	—	—

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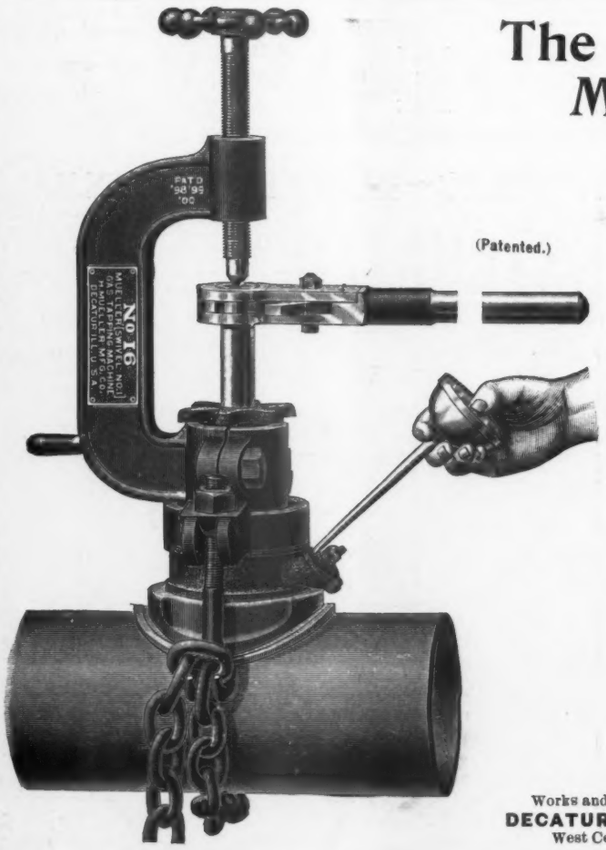

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MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October, 1910. New York City. Officers: President, Wm. H. Bradley, N. Y., City Secretary, A. B. Beadle, 29 West 39th street, N. Y. City.

Canadian Gas Association.—Annual meeting, June, 1911. ————————. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, Nov., 1910. New York City. Officers: President, C. R. Huntley, Buffalo, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Guild of Gas Managers of New England.—Annual meeting, December. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, A. K. Quinn; Newport, R. I.; Secretary, Walter G. Africa, Manchester, N. H.

Illinois Gas Association.—Annual meeting, time, March, Chicago, Ills. Officers: President, A. S. Harrington, Chicago, Ill.; Secretary-Treasurer, C. B. Strohn, Elgin, Ill.

Illuminating Engineering Society.—Annual meeting, Baltimore, Md., Oct. 1911. Meetings of Sections, monthly. President, W. H. Gartley, Philadelphia, Pa.; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York: Secretary, Albert J. Marshall, 227 Fulton street. New England, Secretary, L. D. Gibbs 39 Boylston street, Boston, Mass. Philadelphia, Secretary, F. N. Morton, Broad and Arch streets Chicago, Secretary, T. R. Beebe, 157 Michigan avenue,

Indiana Gas Association.—Annual meeting, January 19, 1911, Fort Wayne, Ind. Officers: President, Carl H. Graf, Indianapolis; Vice-President, S. E. Mulholland; Secretary-Treasurer, Philmer Eves, Indianapolis Gas Company, Indianapolis, Ind.

Iowa District Gas Association.—Annual meeting, time, June, 1911, ————————. Officers: President, Austin Burt, Waterloo, Ia.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, ———— Wichita, Kas. Officers: President, W. A. Scothorn, Hutchinson, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association.—Annual meeting, time, Sept. 9 to 12, 1910; Aboard Boat, "Georgian Bay." Officers: President, B. O. Tippy, Grand Rapids, Mich.; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April 13, 14 and 15, 1911; St. Louis, Mo. Officers: President, R. J. Irvine; Secretary and Treasurer, W. J. Cunningham, Springfield, Mo.

National Commercial Gas Association.—Annual meeting, December, 1911: Boston. Officers: President, E. N. Wrightington, Boston; Secretary, Louis Stotz, 36 West 39th street, New York City.

Natural Gas Association.—Annual meeting, May 16, 17 and 18, 1911; Pittsburgh, Pa. Officers: President, John M. Garard, Columbus, O, Secretary, T. C. Jones, Delaware, O. Editor Wrinkle Department, F. W. Stone, Ashtabula, O.

New England Gas Association.—Annual meeting, third Wednesday in February; Boston. Officers: President, W. H. Snow, Holyoke, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

Oklahoma Public Utilities Association.—Annual meeting, May 9, 10 and 11, 1911. Officers: President, E. C. Reynolds; Secretary, Galen Crow, Guthrie, Okla.

Pacific Coast Gas Association.—Annual meeting, Sept. 20, 21 and 22, 1910, Los Angeles, Cal. Officers: President, W. B. Cline, Los Angeles, Cal.; Secretary-Treasurer, John A. Britton, 925 Franklin street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, April, 1911, Reading, Pa. Officers: President, J. H. Keppelman, Reading, Pa.; Secretary-Treasurer, William H. Merritt, Lebanon, Pa.

Society of Gas Lighting.—Annual meeting, December, 1910; monthly meeting, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 1123 Broadway, New York.

Southern Gas Association.—Annual meeting, Feb. 16, 1911, Montgomery, Ala. Officers: President, H. W. Frund, Salisbury, N. C.; Secretary-Treasurer, Jas. Ferrier, Rome, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. May, 1911, ———— Tex. Officers: President, W. B. Tuttle, San Antonio, Tex.; Secretary, H. B. Head, Stephensville, Tex.

Wisconsin Gas Association.—Annual meeting, May ————, 1911, Milwaukee, Wis. Officers: President, W. H. Winslow, Superior, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.

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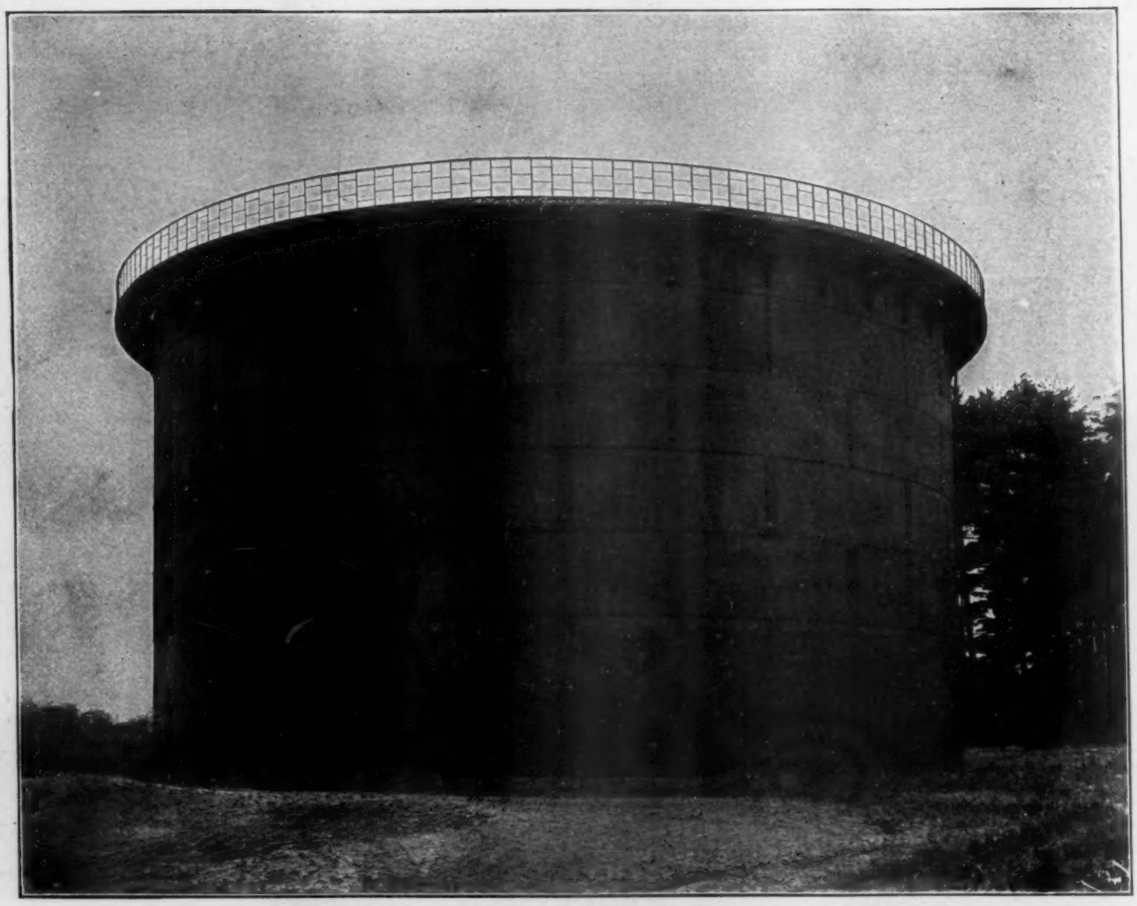

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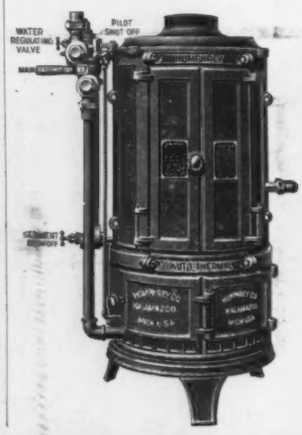

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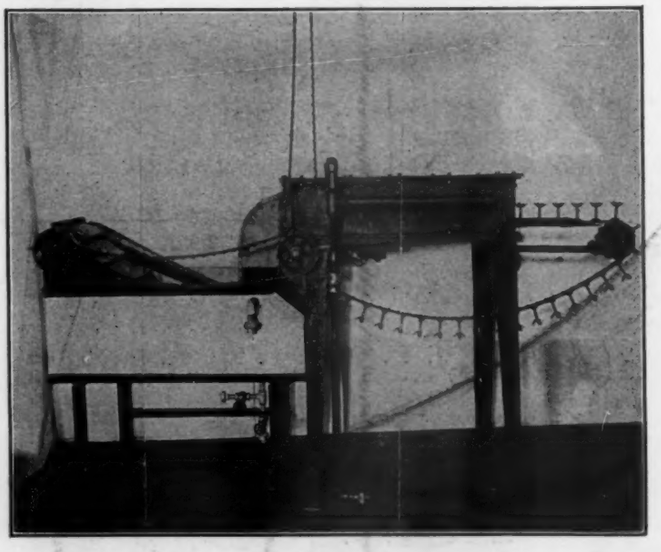

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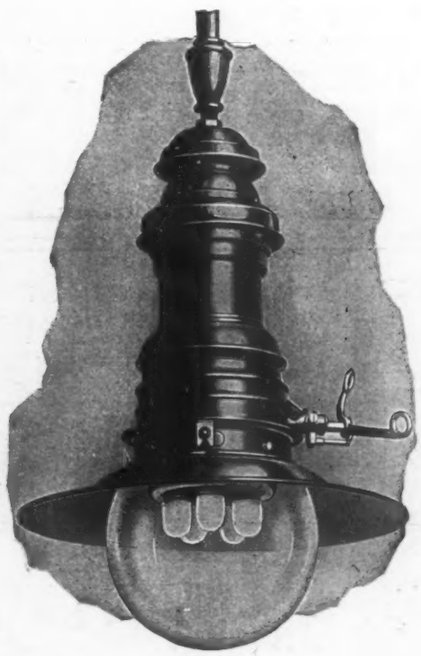

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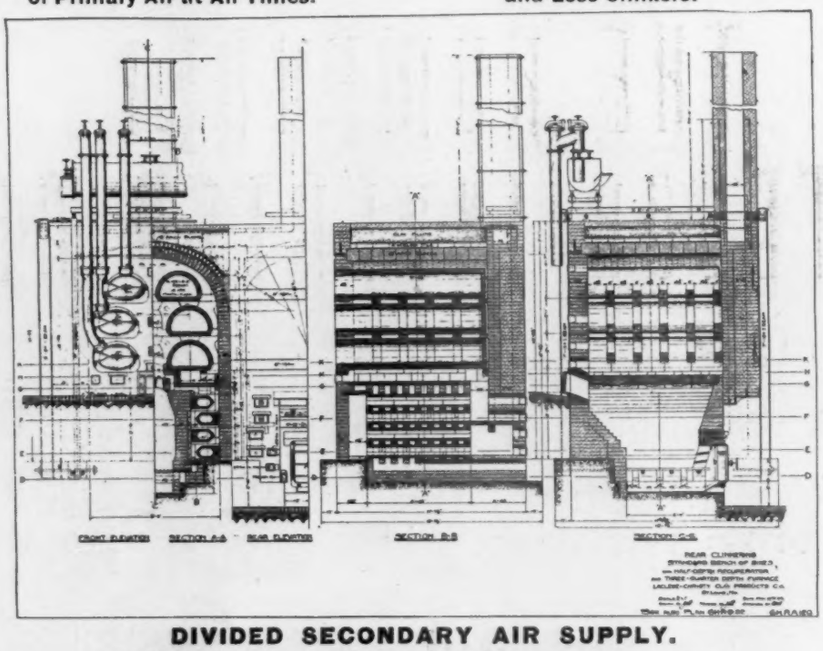

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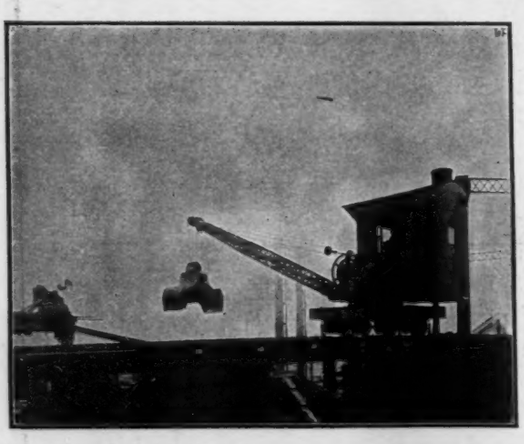

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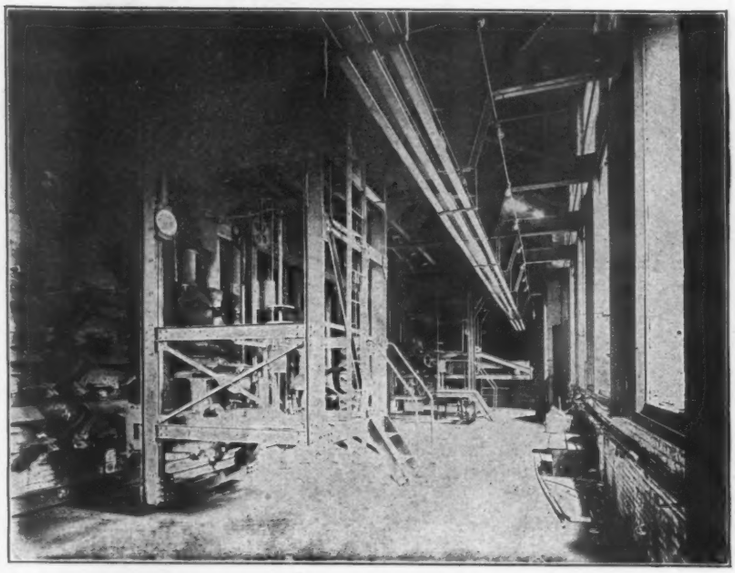

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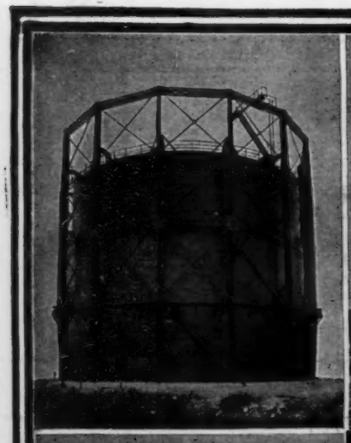
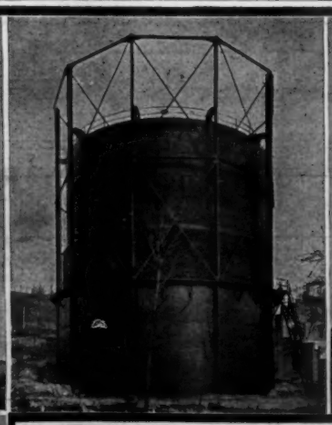

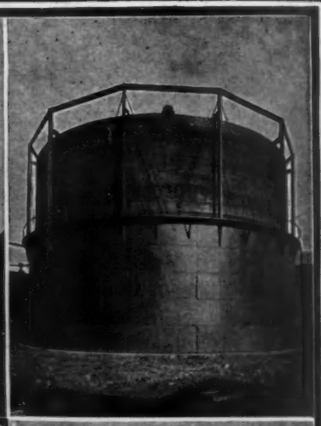

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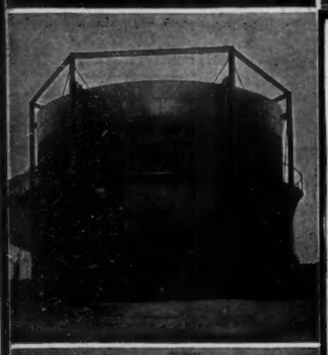

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COATESVILLE, PA. (Am. Gas),	150,000 cu. ft.
RALEIGH, N. C.,	150,000 cu. ft.
PLEASANTVILLE, N. J.,	200,000 cu. ft.
SHAMOKIN, PA.,	200,000 cu. ft.
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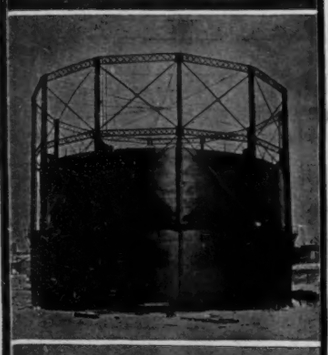

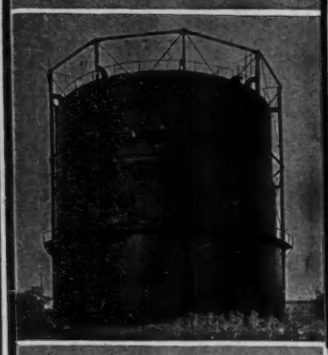
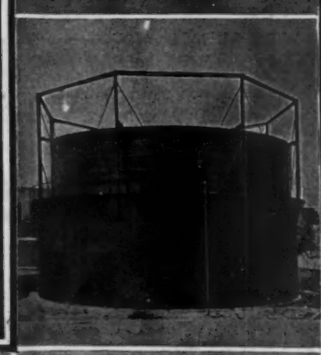
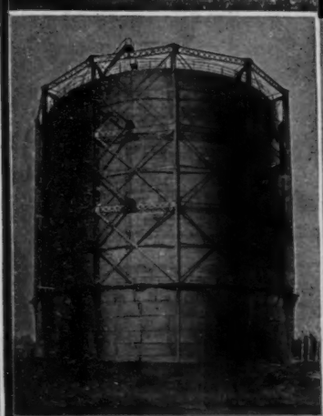
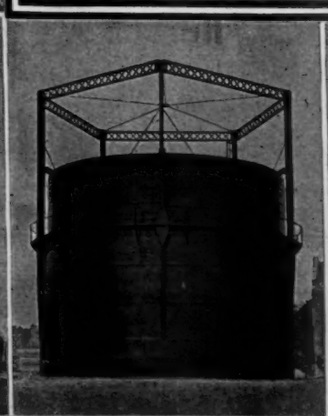

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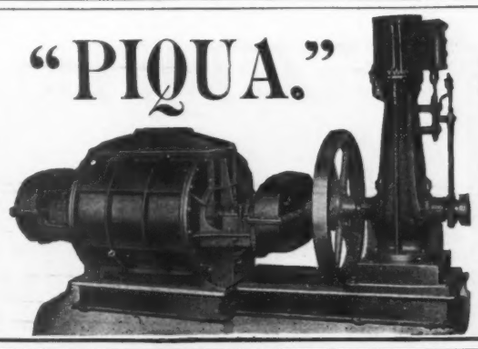

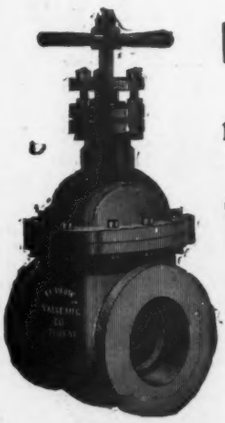

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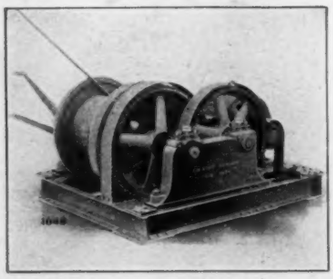

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PUBLIC LIGHTING TABLES FOR AUGUST, 1910.

[COMMUNICATED BY THE AMERICAN METER COMPANY.]

Table No. 1.
FOLLOWING THE MOON.

Day of Week.	Date.	Light.	Extinguish.
		P.M.	
Mon.	1	7.40	4.00 A.M.
Tue.	2	7.40	4.00
Wed.	3	7.40	4.00
Thu.	4	7.40 N.M.	4.00
Fri.	5	7.40	4.00
Sat.	6	7.40	4.00
Sun.	7	7.40	4.10
Mon.	8	7.40	4.10
Tue.	9	7.40	4.10
Wed.	10	8.00	4.10
Thu.	11	9.20	4.10
Fri.	12	9.50 F.Q.	4.10
Sat.	13	9.20	4.10
Sun.	14	10.50	4.10
Mon.	15	10.30	4.10
		A.M.	
Tue.	16	12.30	4.10
Wed.	17	1.30	4.10
Thu.	18	2.30	4.10
Fri.	19	No L.	No L.
Sat.	20	No L. F.M.	No L.
Sun.	21	No L.	No L.
Mon.	22	7.20 P.M.	9.10 P.M.
Tue.	23	7.20	9.40
Wed.	24	7.20	10.10
Thu.	25	7.20	10.30
Fri.	26	7.20	11.10
Sat.	27	7.20 L.Q.	11.50
Sun.	28	7.10	12.40 A.M.
Mon.	29	7.10	1.30
Tue.	30	7.10	2.40
Wed.	31	7.10	4.30

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Complete Lighting in 1 Hour.	Complete Extinguishing in 50 Minutes.
		From Time Given.	
		P.M.	A.M.
Mon.	1	7.02	3.27
Tue.	2	7.02	3.27
Wed.	3	7.02	3.27
Thu.	4	7.02	3.27
Fri.	5	7.02	3.27
Sat.	6	6.57	3.37
Sun.	7	6.57	3.37
Mon.	8	6.57	3.37
Tue.	9	6.57	3.37
Wed.	10	6.57	3.37
Thu.	11	6.57	3.37
Fri.	12	6.57	3.37
Sat.	13	6.47	3.47
Sun.	14	6.47	3.47
Mon.	15	6.47	3.47
Tue.	16	6.47	3.47
Wed.	17	6.47	3.47
Thu.	18	6.47	3.47
Fri.	19	6.47	3.47
Sat.	20	6.37	3.52
Sun.	21	6.37	3.52
Mon.	22	6.37	3.52
Tue.	23	6.37	3.52
Wed.	24	6.37	3.52
Thu.	25	6.37	3.52
Fri.	26	6.37	3.52
Sat.	27	6.27	3.57
Sun.	28	6.27	3.57
Mon.	29	6.27	3.57
Tue.	30	6.27	3.57
Wed.	31	6.27	3.57

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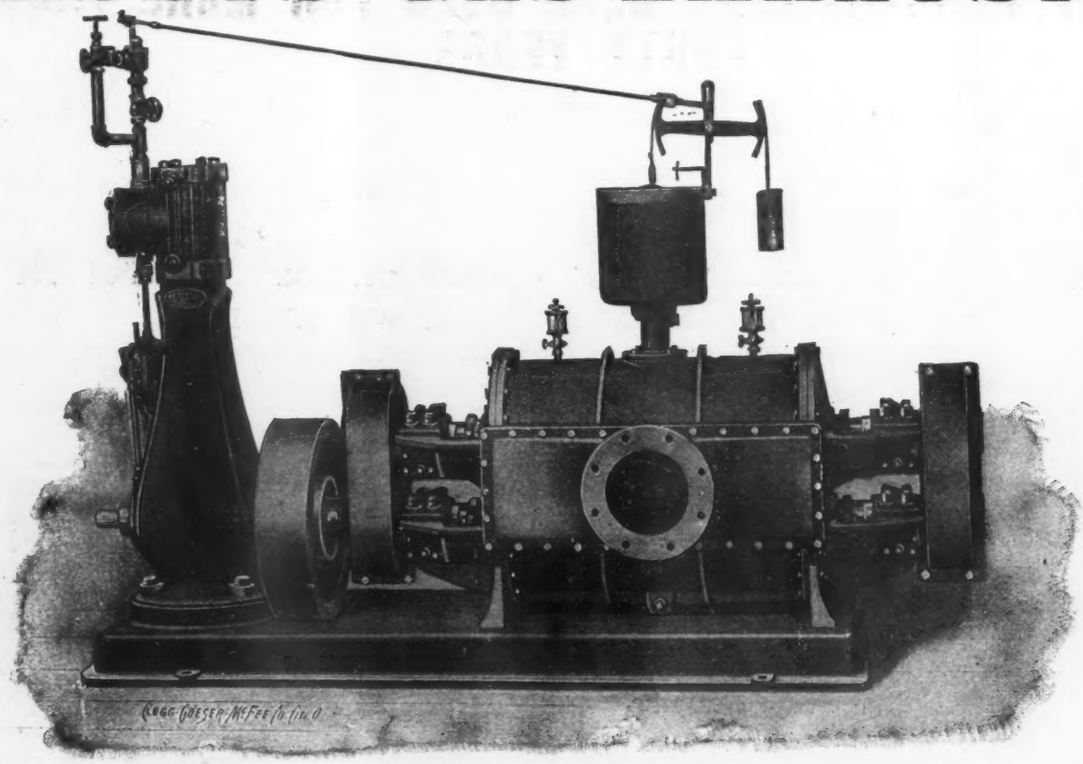

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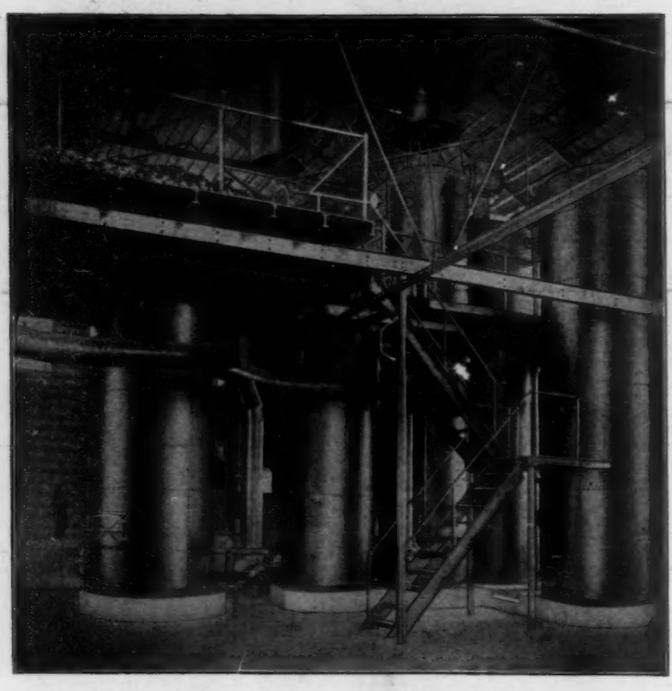

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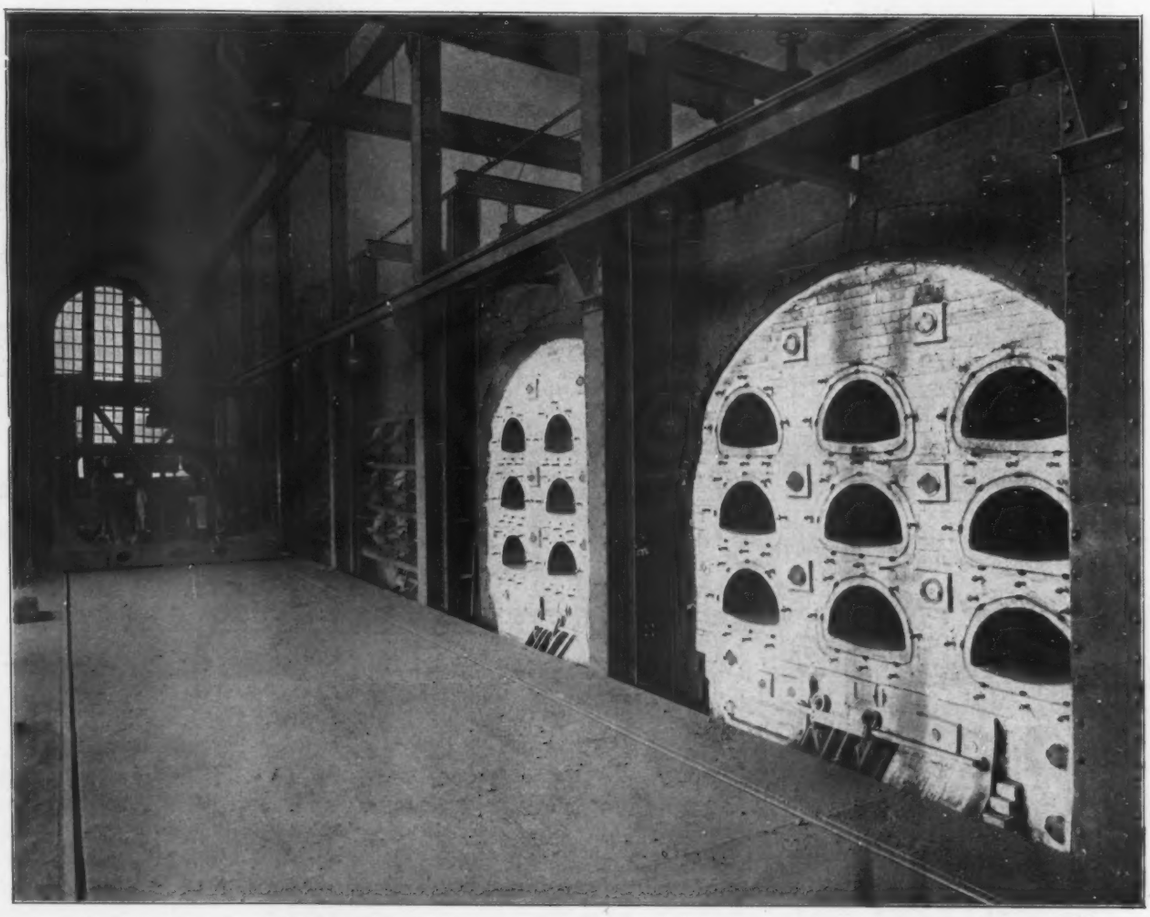

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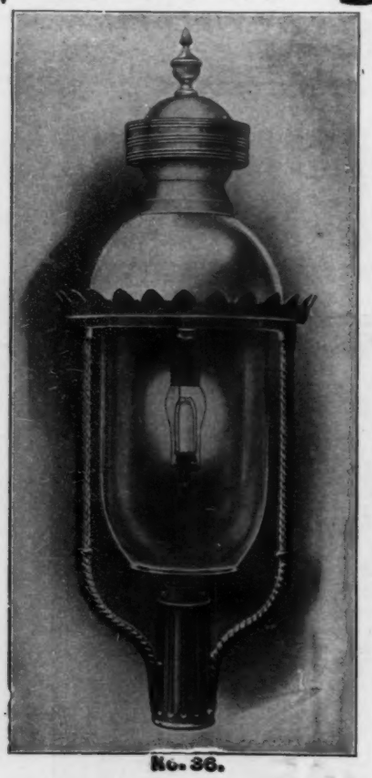

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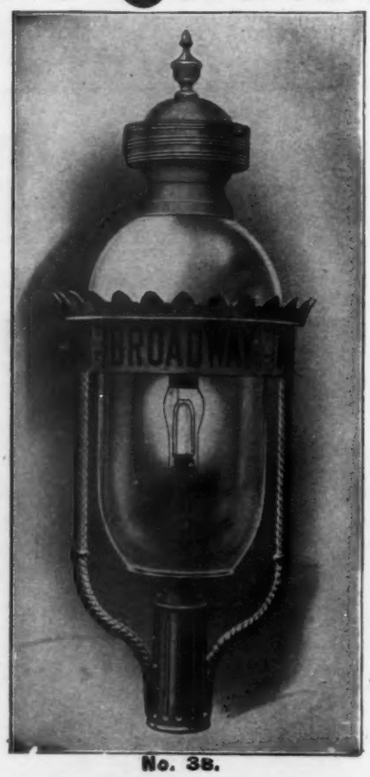

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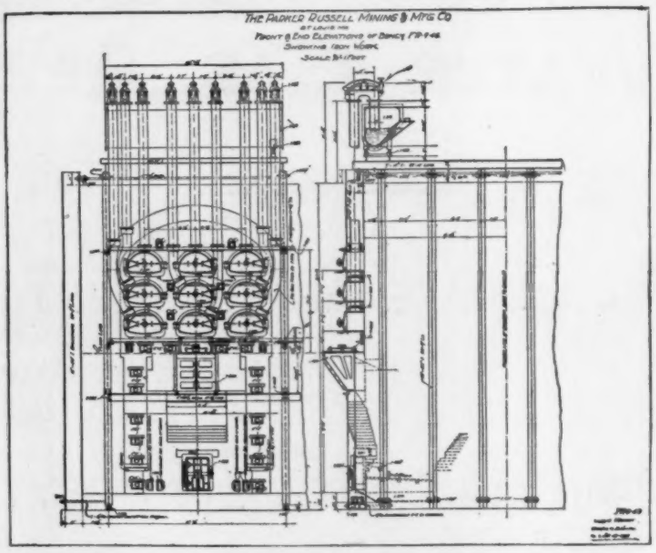

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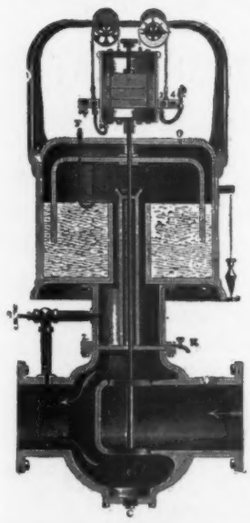

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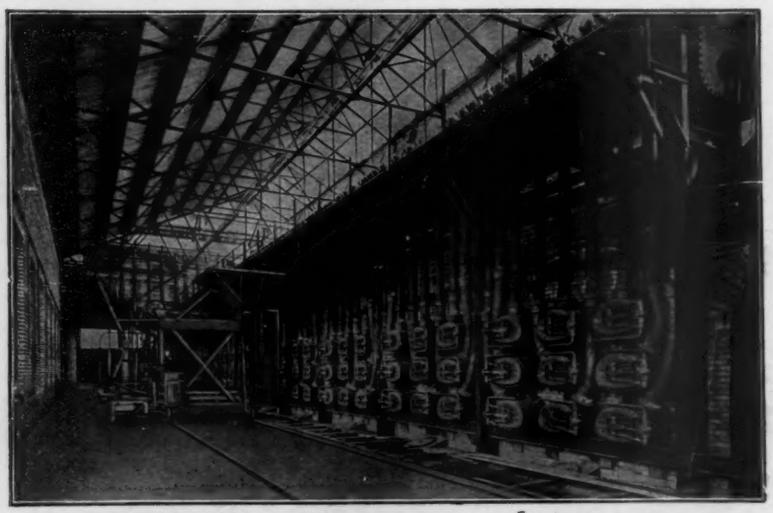

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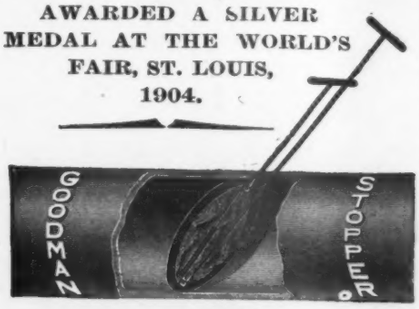

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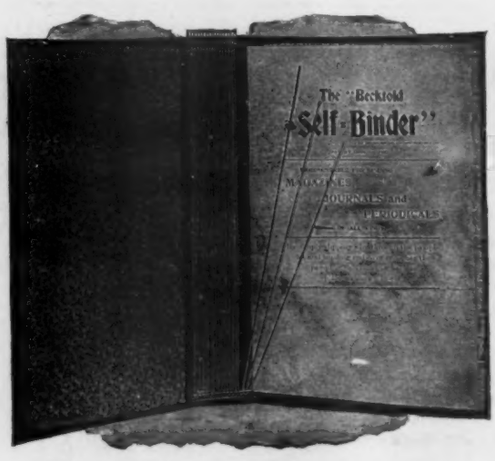

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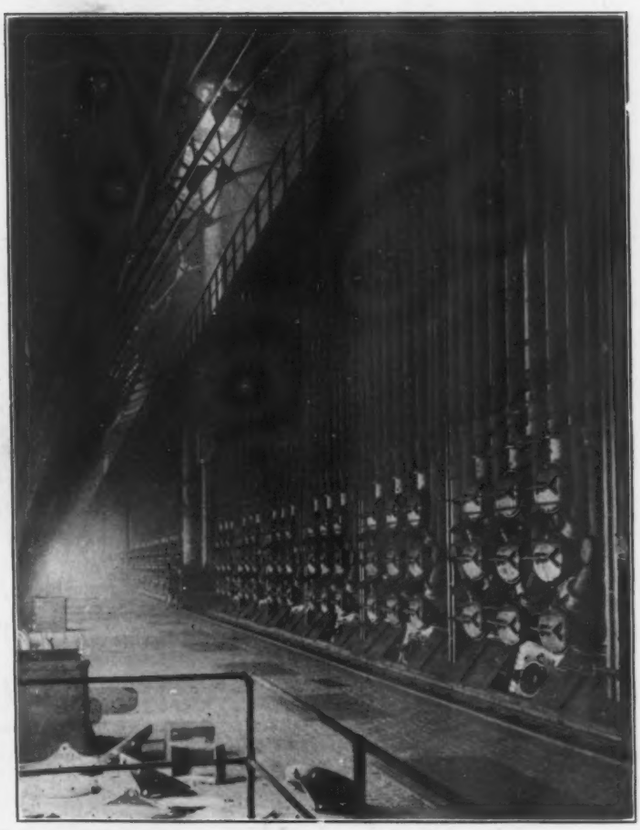

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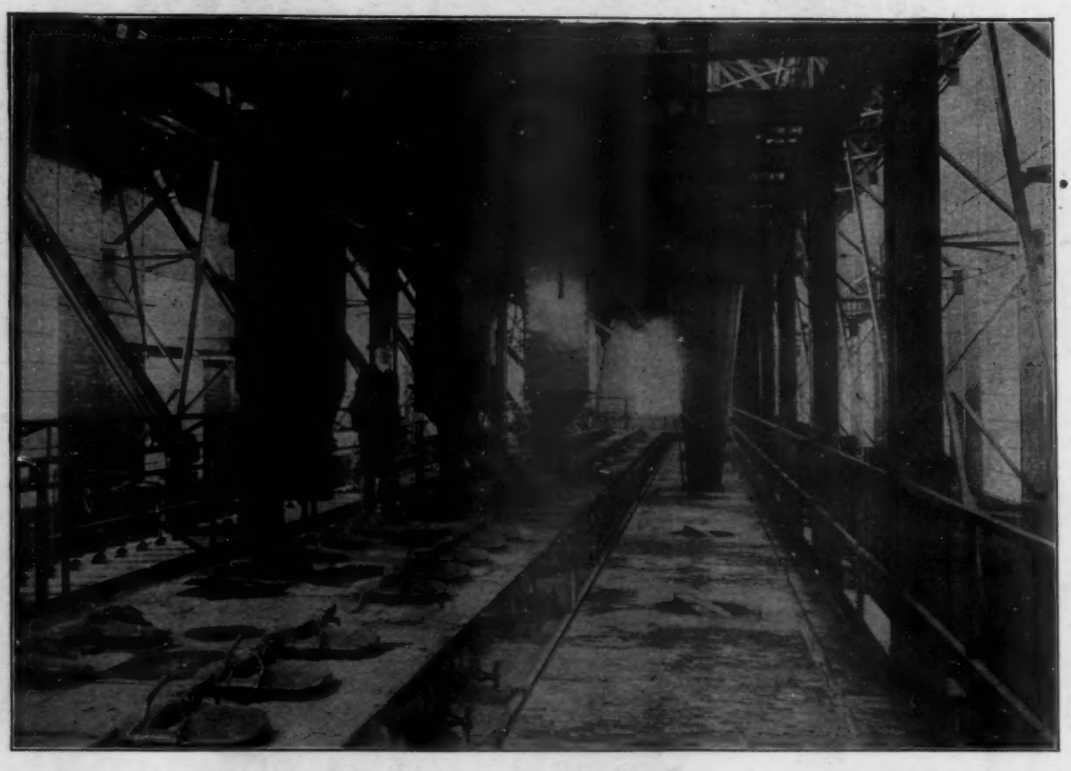

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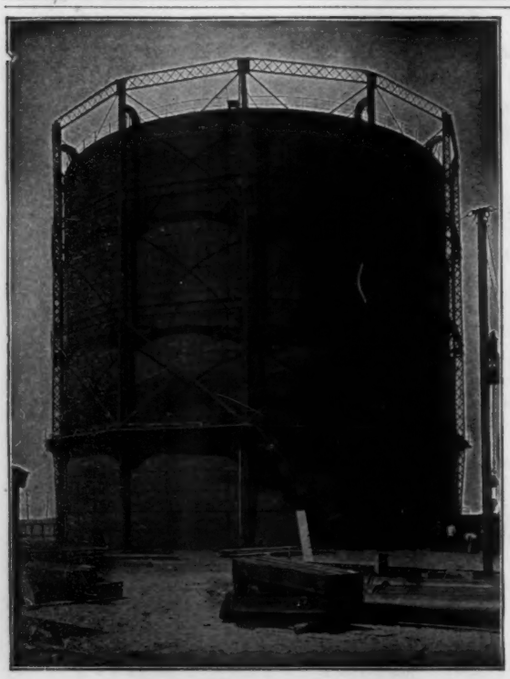

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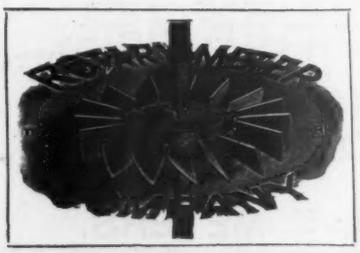

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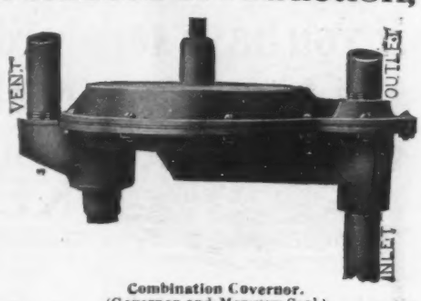

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